

THE ANALYSIS OF UNIT COST OF
IN- PATIENT SERVICES AT THE UROLOGY
DEPARTMENT IN THAI NGUYEN GENERAL HOSPITAL
IN VIETNAM

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บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)

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การศึกษาด้านทุนต่อหน่วยการให้บริการผู้ป่วยในของแผนกทางเดินปัสสาวะของ
โรงพยาบาล THAI NGUYEN GENERAL ในเวียดนาม

นางสาวเอื้อง ที แวน อังห์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

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งานวิจัยนี้เป็นการศึกษาเชิงพรรณนามีวัตถุประสงค์เพื่อวิเคราะห์โครงสร้างต้นทุนและต้นทุนต่อหน่วยของการให้บริการผู้ป่วยในและผู้ป่วยนอกของแผนกศัลยกรรมทางเดินปัสสาวะของโรงพยาบาล Thai Nguyen ประเทศเวียดนาม เป็นการศึกษาในมุมมองของผู้ให้บริการ โดยเก็บข้อมูลตั้งแต่วันที่ 1 มกราคม ถึง 31 ธันวาคม พ.ศ. 2554 และวิเคราะห์โดยแบ่งหน่วยงานทั้งหมดภายในโรงพยาบาลออกเป็น 3 กลุ่มคือ หน่วยต้นทุนที่ไม่ก่อให้เกิดรายได้ หน่วยต้นทุนที่ก่อให้เกิดรายได้ และหน่วยต้นทุนที่ให้บริการผู้ป่วย โดยต้นทุนทางตรงรวม (total direct costs) ถูกประมาณจากต้นทุนแรงงาน (labor costs) ต้นทุนค่าวัสดุดิบ (material costs) และต้นทุนการลงทุน (capital costs) ซึ่งประกอบด้วยค่าสิ่งปลูกสร้าง (costs of building) และเครื่องมือทางการแพทย์ต่างๆ (costs of equipments) การคำนวณต้นทุนต่อหน่วยใช้วิธีการกระจายตามลำดับขั้น (step – down method)

โดยกระจายต้นทุนไปตามหน่วยต้นทุนตามเกณฑ์ที่สร้างขึ้นเฉพาะของแต่ละหน่วยต้นทุน ต้นทุนรวมทั้งหมด (full costs) ของแผนกศัลยกรรมทางเดินปัสสาวะมีมูลค่า 20,455 ดอลลาร์สหรัฐ โดยมีจำนวนผู้ป่วยใน 503 ราย คิดเป็น 6,016 วันนอน (in-patient days) ต้นทุนต่อหน่วยในการให้บริการผู้ป่วยในคือ 3.4 ดอลลาร์สหรัฐ ซึ่งมากกว่าค่าบริการต่อวันที่โรงพยาบาลเรียกเก็บสำหรับการพักรักษาตัวในโรงพยาบาลถึง 7.23 เท่า โรงพยาบาลควรเน้นการใช้เครื่องมือทางการแพทย์ที่มีคุณภาพสูงและใช้ได้นานเพื่อลดต้นทุนการลงทุน และลดช่องว่างระหว่างต้นทุนต่อหน่วยและค่าบริการที่เรียกเก็บ

รัฐบาลควรจะต้องจัดสรรทรัพยากรให้แก่โรงพยาบาลตามคุณภาพบริการแทนที่จะใช้จำนวนเตียงผู้ป่วย

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This research is a descriptive study aimed at analyzing the cost structure and unit cost of in – inpatient services at urology department of Thai Nguyen General Hospital in 2011. This study was carried out from 21/03/2012 to 2/4/2012. This study is based on the provider perspective. All departments at Thai Nguyen general hospital were classified into three groups which include non-revenue producing cost centers, revenue producing cost centers and patient service centers. The total direct cost of Thai Nguyen general hospital is estimated by considering labor cost, material cost and capital cost, where capital cost includes the cost of building and the cost of equipment. The step – down method is used to allocate cost among cost centers. The allocation is based on allocation criteria which were created specifically for each cost centers.

The full cost of the urology department was US\$ 20,455 in 2011 the number of in-patients in this department was 503 and the number of inpatient days was 6,016. The unit cost of inpatient services at urology department was US\$ 3.4. This unit cost was 7.23 times higher than partial user-fee for one inpatient service. To reduce the gap between unit cost of inpatient services at urology department and the partial user-fee for one inpatient service, the hospital should focus on using the high quality, high technology and long useful life equipment to reduce capital cost. Government should allocate resources to hospital based on quality of hospital instead using number of hospital beds.

Field of Study : Health Economics and Health Care Management Student's Signature

Academic Year : 2011..... Advisor's Signature

Co-advisor's Signature

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LIST OF ABBREVIATIONS

Abbreviation	Full name
Who	World health organization
NRPCC	Nonrevenue producing cost center
RPCC	Revenue producing cost center
PS	Patient service
NPS	Non patient service
FC	Full cost
DC	Direct cost
IDC	Indirect cost
IPD	Inpatient day
USD	United states dollar

CHAPTER I

INTRODUCTION

1.1 Problem and Significance

Kidney disease is now considered one of the leading causes of death worldwide. The scope of this disease is increasing widespread in the world from the developed countries to developing countries.

There are many causes of kidney disease but mainly due to diabetes and high blood pressure. Because of economic development, people change their life habit and eating habit, it is a reason to increase diabetes and high blood pressure. Following a research of WHO, there are 1.1 million deaths due to diabetes, take 1.9% of total death due to many diseases. This research also showed that diabetes appearance mainly in high income countries and middle income countries (WHO, 2004). People with diabetes and high blood pressure will have a high risk to have renal disease and their health will be affected. The report of US National Kidney Foundation showed that there are 26 million American have chronic kidney disease, more than 88 thousand Americans are waiting for renal transplantation and more than 380 Americans are depended on dialysis to keep their life (National Kidney Foundation, 2011).

Kidney plays an important role in human healthcare, it is crucial 100% in the blood circulation of human body and it also participates in other important functions such as remove toxic substances in the blood, regulate water in human body, control blood pressure, create red corpuscle and the balance of acids and minerals. When you have kidney problems these functions will be affected and make a negative impact to

human health. Kidney disease is not only causes serious diseases, it also causes a economic burden by reducing labor productivity, affecting the quality of work, affecting the income of household because kidney disease often lasts and most can only remain stable but cannot cure the disease. The result of one research carried out in Australia showed that the average cost of receiving dialysis in hospital is \$ 82,764 per person per year and the cumulative cost of dialysis from 2004 – 2010 is expected to be \$ 4,5 billion dollars (Cass et al, 2006). This cost is not a small proportion of the budget for health care compared to a developed country like Australia. For developing countries, especially Vietnam, the cost for treating kidney disease is actually a big burden.

At the present, the number of people with chronic renal failure in Vietnam was estimated up to 6 million people in 2010 (representing 6.73% of the population). Chronic renal failure increases rapidly with increasing rate of diseases such as high blood pressure, diabetes, glomerular nephritis and anemia (Vietnam Medical Information, 2010). For treatment of renal failure, each year the patient must spend at least 100 million VND. Patient with renal failure have to have dialysis 3 times per week (about 1.5 million VND equal 71 USD) and must maintain it until the end of their life (Bach Mai Hospital, 2005). Most of the cost of treating kidney failure is come from insurance payments. For those patients without health insurance, most of them are unable to afford, they refuse treatment and wait to die. Kidney disease is considered one of the major health burdens of society. Although in recent years, government has increased spending on health budgets, but due to so many new disease outbreaks, due to be equipped with new machinery and equipment so this amount actually is not enough. While kidney disease is increasing, the economic

burden of treating kidney disease on society is going up, there is suppose to provide research on the economic burden caused by kidney disease for government, it will be a good evidence for improving the capital budget for health care, especially for the treatment of kidney disease.

Base on this situation, research on “*The analysis of unit cost of in-patient services at the urology department in Thai Nguyen General Hospital in Vietnam*” was carried out from 21/03/2012 to 2/4/2012. Thai Nguyen General Hospital is one of the biggest hospitals in Thai Nguyen, which is in the North Vietnam. Hospital is ranking level I which has many modern equipments, high quality health staffs. Urology is one of the strength of this hospital. Urology department in this Thai Nguyen General Hospital just has inpatient services and there is no outpatient service, therefore out – patient service will not be included in this study. Doing research at Thai Nguyen General Hospital will provide the specific number about unit cost (cost per inpatient day) comes from provider perspective and the gap between this unit cost with partial user –fee¹ for one inpatient service unit. This will be a specific evidence for policy maker in resource allocation and hospital fee reform (partial user-fee was issued by government though Decree No. 14/TTLB which is explained specifically in the section on Health Policy on page 59).

1.2 Research question

This research will answer these questions below:

1. What is the unit cost of in-patient services at the urology department in Thai Nguyen General Hospital?

¹ Partial user-fee, which is paid by patient is designed to cover only medicines, blood, chemical, test, X-ray, essential material, healthcare services; and does not include depreciation of capital assets, maintain cost, administrative cost, education cost, science research cost, major capital assets and facilities construction.

2. What is the gap between unit cost of in-patient services at urology department and partial user-fee for one inpatient service unit?

1.3 Objective of study

The objectives of this study are described below here:

General objective

To analyze unit cost of inpatient services at the urology department in Thai Nguyen General Hospital in Vietnam.

Specific objective

1. To calculate total cost of inpatient services at the urology department in Thai Nguyen General Hospital.
2. To calculate unit cost of inpatient services at the urology department in Thai Nguyen General Hospital.
3. To compare the existing unit cost with the partial user – fee for one inpatient service.

1.4 Scope of study

This research analyzed cost and unit cost of inpatient services at urology department by focusing on provider perspective, and this research also focused on kidney related services only, other diseases which are not related with kidney will be not included in this research. It was carried out in Thai Nguyen General Hospital, Thai Nguyen city, Vietnam from 21/3/2012 – 2/4/2012. The data collected will cover the information of the year 2011 of all hospital, especially the information of urology department.

CHAPTER II

LITERATURE REVIEW

In this research, literature review will include a theoretical about the definition and classification of cost, hospital cost, unit cost and perspective or point of view. Because this research is a research on unit cost analysis so the methodological contributions of literature review will focus on steps in hospital cost analysis which includes cost center identification & grouping, direct cost determination, allocation criteria determination, full cost determination and unit cost calculation. And also, literature review will include some previous researches or applied studies due to this topic; these researches will provide a clear overview about health care unit cost in over the world, and the method which they applied in their researches.

2.1 Definition and classification of cost

There are so many definition of cost but to provide fully and clearly a definition of cost, this research will focus on several definition as follow:

Cost can be classified by three types which include direct costs, indirect cost, and general and administrative costs. *Direct costs* are those expenses can be accessed for an output, include capital, labor, direct materials consumed in producing an output. Direct costs are those expenses arise for a specific unit costs and can be related convenient with unit cost. Direct costs are known as production costs. *Indirect cost* which are costs have been incurred for common or joint purposes. Indirect costs benefit more than one cost objective and cannot be readily identified with a particular final cost objective. For example, indirect cost can be the office space rental, utilities, and clerical and managerial staff salaries (United State Department of Education,

2009). *General and administration cost* are costs not associated with any specific product or service. They are referred to as overhead, and are allocated over all outputs produced (Defense Resources Management Institute, and United States Department of Defense Directorate for Financial Review and Analysis, 1996)

In the economic view, cost can be classified by cost behavior which includes fixed cost and variable costs. *Fixed costs* are those costs that, over some specific time period, do not vary with quantity of output. Fixed costs refer to keep constant to not be impacted by the change in the amount of output, as well as monitoring salaries, rent, taxes, etc. *Variable costs* are those cost that vary directly with quantity of output. Variable costs change directly with amount of output, include direct materials, direct labor and direct costs. *Semi – fixed/semi – variable cost* is the cost was mixed between one part of fixed cost and one part of variable cost, for example telephone expense, electricity payment, etc (Defense Resources Management Institute, and United States Department of Defense Directorate for Financial Review and Analysis, 1996).

Accounting costs are costs related to production costs. While the economic costs include not only production costs but it also includes the opportunity cost of production is ignored by this product.

Explicit costs are payments are made for others as a commerce expense of one company. For example, in a firm, explicit cost of will consist salaries paid for labor and cost of materials, electricity, telephone and advertising, rental cost of for this company, health insurance for workers (Robert, 2006).

Implicit costs are costs refer to the resource value used in manufacturing without a currency payment is done. For a company, implicit costs meaning opportunity cost such as salaries be skipped of the company owner who used his time

to carry out the business. It can also involve interest be skipped because the owner invested his money in the company and not deposit in his savings account at a bank. If building of the owner is used to open the company, he also loses money received from other tenants (Robert, 2006).

Opportunity cost is used to refer to the profit foregone from the next best alternative. And sometimes opportunity cost is used to refer to the difference between the profit from the action taken and the profit foregone from the next best alternative (Caplan, 2010).

And one more kind of cost should be include in this part is sunk cost. Normally, sunk cost is not included in estimation period but the evaluator should know about that. Sunk costs are costs that were incurred in the past; this cost is irrelevant for decisions because they cannot be changed (Caplan, 2010).

2.2 Hospital cost

In this part, there will be a clear definition about hospital cost and the important of hospital cost.

Hospital cost include two components: the hotel cost which is broadly constant over the length of stay, and the treatment cost which is very high after admission but then reduce in the later days of the stay (Drummond et al, 2005)

Hospital costs are important information because it comes from the inputs of the monetary resources and the output of services produced hospital. This information is essential for managers and policy makers in improving the quality of the hospital, how to allocate costs in hospitals, or compare the quality of services among hospitals. Information on hospital costs to help improve efficiency, sustainability and quality of the hospital (New brander, and Lewis, 2007)

2.3 Unit cost of hospital

Unit cost is very important information for hospital management to improve efficiency of hospital and it is needed for policy maker for allocating resources. Unit cost is the "average total cost" of the production of a unit of output. A unit cost can be counted by dividing total costs of production by the total number of production units. Output is a completed product at the end of a production process. It can be a goods or a service and can be measured (Defense Resources Management Institute, and United States Department of Defense Directorate for Financial Review and Analysis, 1996).

In health economics point of view, unit cost is calculated by dividing the total cost of patient service by the total number of unit of output. For inpatient care, the usual choices of unit of output are inpatient-days or admissions. For outpatient care, number of visits is the unit of output (Shepard, Hodgkin, and Anthony, 2000).

2.4 Perspective or point of view

The perspective is the point of view from which the costs and benefits are recorded and assessed. It can be apart from the societal/economic perspective, which represents the most comprehensive approach, other perspective are possible such as the health system, social insurance, other service providers (hospitals) and patient. There are three mainly perspective which used in health economics as described in thesis of Suppagee Na Pattalung as following:

The cost of provider perspective mentions all cost arisen in the supply medical services to patients, which includes cost of labor, material costs and capital costs. This cost is not equivalent to a fee for service payments for patients (Pattalung, 2004).

Costs based on patient perspective mentions all costs arising from hospital treatment. This cost covers the cost caused by illness, such as income reduced or lost when getting sick (Pattalung, 2004).

Cost in the society perspective refers to the sum of all expenses incurred, for instance, sick leave, environmental pollution or a harmful epidemic (Pattalung, 2004).

2.5 Steps in Hospital cost analysis

There are five steps in hospital cost analysis which include Cost center identification & grouping; direct cost determination; Allocation criteria determination; Full cost determination and Unit cost calculation.

Cost center Identification & Grouping

There are so many ways for identifying cost center. For an administrative stand point, cost centers can be distinguished according to the nature of their work – patient care, intermediate clinical care, and overhead (Shepard, Hodgkin, and Anthony, 2000).

- *Patient care:* These centers provide service directly for patient such as surgery, dentistry...
- *Intermediate:* These centers support Patient care units but they were put in other departments, such as X – ray, pharmacology.
- *Overhead:* These centers support both patient care units and intermediate center, such as security, finance, administration, supply department....

Cost center can be distinguished in another way which was mention in some research. There are four main groups of cost center which include non revenue producing cost center, revenue producing cost center, patient service and non patient service (Kamolratanakul, 2000).

- *Non – Revenue Producing Cost Center*: NRPCC related to those departments which support both revenue producing cost center, patient service and non patient service. For example, Administration, Finance. These centers will not get money directly from patients.
- *Revenue Producing Cost center*: RPCC related to those departments which supply healthcare service to patient. And these centers can get money directly from patients, such as X – ray, Pharmacology, ...
- *Patient Service Area*: PS are those departments which provide service directly to patients, they include in – patient service and out – patient service, such as surgery, pediatric, obstetric, Tuberculosis department...
- *Non-Patient Service Area*: NPS refers to any departments that provide service relating to Health Promotion and Disease Prevention.

Direct cost determination

Direct cost comprises all consumption of resources resulting from a treatment or therapy and directly attributable to this. Direct cost includes direct medical and direct non-medical costs. Direct medical costs arise directly from the treatment (e.g. diagnosis, drug therapy, medical care, in – patient treatment, etc). Direct non-medical costs arise from the consequences of the disease or treatment (e.g. transport costs, care services, etc) (Walter, and Zehetmay, 2006).

Most of researches, direct cost will included three main components are labor cost, material cost and capital cost.

Labor cost refers to direct salaries paid to employees for the time they produce the finished product in the production process. There are two type of labor cost: direct labor cost and indirect labor cost. Labor costs include direct labor costs from

individual units of the product. Direct labor is also known as touch labor because workers who make products directly in the production process. Labor costs are not derived from the specific products or arising in the major cost and inconvenience known as indirect labor. Indirect labor costs involve any other expenses that a business indirectly arises as improving knowledge of staff by training (Caplan, 2010).

Material Cost mentions all types of materials for every cost center. These costs consist primarily provide pharmaceutical supplies. Cost of materials also mentions maintenance costs and utility costs. Records can be used to estimate the cost of materials if such records updated correctly. Without records, material costs should be calculated by finding the price of raw materials and their quantity (Supachutikul, 1997).

Capital Cost includes cost of building, equipment and vehicles. Building: construction or modification but not routine maintenance, which is included in recurrent costs). Equipment: major equipment purchased for the facility. Vehicles include cars, trucks, ambulances, motorcycles and even bicycles. Vehicles are assumed to have a shorter life than other hospital equipment and are depreciated over 5 years (New brander, and Lewis, 2007)

Capital cost is the cost to buy the major capital assets which is required by department/project/program. For general, the major capital assets are equipments, building, vehicles, and land. There is a difference between capital cost and operating cost, capital cost is cost which invested at the beginning of the project/program while operating cost is the annual sums (Drummond, et al, 2005)

In capital costs, an asset will be used over time such as equipment, building, and vehicle. However, land is considered as non - depreciable asset because it

maintains its value. Capital cost has two components: The opportunity cost and the depreciation over time of the asset.

The opportunity cost of the funds tied up in the capital asset. For example, Drummond et al. (2005) showed that although an investment in non-depreciable land will return the original capital sum when sold, there is still a 'cost'. It is called the lost opportunity to invest the sum in other venture yielding positive benefits. This 'cost' can be valued by applying an interest rate to the amount of capital invested (Drummond, et al, 2005).

The depreciation over time of the asset is the second component of capital cost. For calculating this value of capital cost we can use straight line, declining balance, double declining balance. The best method is to annuitize the initial capital outlay over the useful life of the assets is to calculate “the equivalent annual cost” (Drummond, et al, 2005). The way to calculate equivalent annual cost is mentioned below in economic depreciation part.

Economic depreciation

Depreciation is a non – cash expense, it reduce value of an asset over times (Jean, M, 2012). The reasons lead to depreciation:

Attrition: equipments and machines which use in production period will be rust and attired over time, therefore value of those assets will be reduced over times (Jean, 2012).

Out-of-date: value of equipments and machines will be reduced when they out-of-date; and value of equipments and machines will be reduced when they are replaced by new equipments or model equipments (Jean, 2012).

There are a lot of depreciation methods, in this part; three depreciation methods which are common use will be described are straight- line, units-of-production and double-declining-balance.

Straight-line methods

$$D = \frac{\text{Purchase price of asset} - \text{approximate salvage value}}{\text{Estimated useful life of asset (years)}}$$

Source: (Joshua, 2012)

Where:

D: annual depreciation expense

To calculate the annual depreciation expense of an asset, this method use purchase price of asset minus the approximate salvage value and after that dividing by estimated useful life of asset. The salvage value is also known as the residual value (Lucko, and Vorster, 2003) which is an estimate of the value of the asset at the time it will be sold or disposed of, residual value can be equal 0 or negative.

For example a computer that depreciates over 5 years, is purchased at a cost of US\$ 500 and have a residual value of US\$ 10, will have annual depreciation at US\$ 98.

$$\text{Annual depreciation expense} = (\$500 - \$10) / 5 = \$98$$

Table shows below here will describe clearly the straight-line method of depreciation.

Table 2.1 Straight-line depreciation

<i>Value at the beginning of the year (\$)</i>	<i>Depreciation expense (\$)</i>	<i>Accumulated depreciation (\$)</i>	<i>Value at end of year (\$)</i>
500	98	98	402
402	98	196	304
304	98	294	206
206	98	392	108
108	98	490	10

Source: Author

So the value at end of year of an asset = original cost of an asset – accumulated depreciation

Units-of-production depreciation method

$$D = \frac{\text{Purchase cost of capital asset} - \text{residual value}}{\text{Life in units}} \times \text{Unit used}$$

Source: (Nabeela, 2010).

Where

D: annual depreciation expense

Life in units is the estimated total production of capital asset's life. For example: a motorbike has a life of 300 miles; a photocopy machine has a life of 5000 pages

Unit used is the actual production of capital asset. For example: during one year a motorbike recorded 60 miles; and a photocopy machine copied 1000 pages per year

To calculate the annual depreciation expense of an assets, this method use purchase cost of capital asset minus residual value of this asset and then dividing by life in units, after that multiple with unit used to have the depreciation cost of the current year.

For example a photocopy machine has original cost of US\$ 600, residual value of US\$ 20, and is expected to photo 5000 pages (units). So the depreciation per page (unit) is US\$ 0.116.

$$\text{Depreciation per unit} = (\$600 - \$20) / 5000 = \$0.116$$

And if the unit used of one year of this photocopy machine is 1000 pages (units)

$$\text{Depreciation cost of the current year} = \$0.116 \times 1000 = \$116$$

Table 2.2 Units-of-production depreciation method

<i>Value at the beginning year (\$)</i>	<i>Units of production</i>	<i>Depreciation cost per unit (\$)</i>	<i>Depreciation expense (\$)</i>	<i>Accumulated depreciation (\$)</i>	<i>Value at end of year (\$)</i>
600	1000	0.116	116	116	484
484	1000	0.116	116	232	368
368	1000	0.116	116	348	252
252	1000	0.116	116	464	136
136	1000	0.116	116	580	20

Source: Author

Double - Declining - balance method (reducing balance method)

$$D = \text{DDB\%} \times \text{Book Value}$$

Book value = Purchase cost of capital asset at beginning of year – accumulated depreciation

$$\text{DDB\%} = \frac{100\%}{\text{Useful life of asset}} \times 2$$

Source: (Nabeela, 2010)

Where

D is depreciation expense

DDB% is double- declining-balance percentage

From this method, we can have a higher depreciation charge in the first year of an asset's life and gradually reducing charge in subsequent years. This method seem to be more realistic because most of assets are more useful when they are new. To calculate depreciation, this method use double-declining-balance percentage multiple with book value of an asset.

For example, calculate the annual depreciation expense of an asset is purchased at US\$ 700, residual value at US\$ 30 and has 5 years useful life.

First, we have to estimate the DDB%

$$\text{DDB\%} = (100\%/5) \times 2 = 40\% \text{ per year}$$

$$\text{Book value of asset at the beginning of the year} = \$700 - 0 = \$700$$

$$\text{Depreciation expense at the first year} = 40\% \times \$70 = \$280$$

Table 2.3 Double-declining-balance method

<i>Book value at beginning of year (\$)</i>	<i>Depreciation of rate (%)</i>	<i>Depreciation expense (\$)</i>	<i>Accumulated depreciation (\$)</i>	<i>Book value at end of year (\$)</i>
700	40	280 (1)	280	420
420	40	168 (2)	448	252
252	40	100.8 (3)	548.8	151.2
151,2	40	60.48 (4)	609.28	90.72
90,72	40	60.72 (5)	670	30

Source: Author

$$(1) \$700 \times 40\% = \$280$$

$$(2) \$420 \times 40\% = \$168$$

$$(3) \$252 \times 40\% = \$100.8$$

$$(4) \$151.2 \times 40\% = \$60.48$$

$$(5) \$90.72 \times 40\% = \$36.288$$

Because residual value of this asset is \$30, to keep book value same as residual value depreciation for the fifth year is \$60.72

$$\$90.72 - \$30 = \$60.72 \text{ (at this point depreciation stops)}$$

Comparison among three depreciation methods

Table 2.4 Advantages and disadvantage of depreciation methods

	<i>Advantages</i>	<i>Disadvantages</i>
<i>Straight- line</i>	<p>- This is the simplest and easiest method to calculate because the formula to calculate depreciation is very basic and simple (Hill, 1999).</p> <p>- With this method, we count an even amount of depreciation per year. If spread the use of an asset out evenly over its useful life, this method is the best option. Because of this even distribution, this method allows to easily project expenses and deductions over the next several years.</p>	<p>- This method does not take into account factor that as years passes the efficiency of asset declines (Regulated industries commission, 2005).</p> <p>- This method cannot be used for those machines where it is difficult to estimate the useful life of the machines (Hill, 1999)</p>
<i>Unit-of-production</i>	- This method can be appropriate where there is a	- No depreciation under this method is charged when an

<p><i>high correlation between activity of an asset and its physical wear and tear (Regulated industries commission, 2005)</i></p> <p><i>- It is easy to calculate the annual depreciation amount and the depreciation is matched to the production quantity (Hill, 1999)</i></p>	<p><i>asset remains idle (Regulated industries commission, 2005)</i></p> <p><i>- This method assumes the asset will depreciate evenly over its productive life (Hill, 1999).</i></p>
<p><i>Double-declining - balance</i></p>	<p><i>- This method is acceptable for income tax purposes</i></p> <p><i>- This method matches the cost and revenue of the business. The greater amount of depreciation provided in initial years is matched against the higher amount of revenue generated by increased production by the use of new asset (Regulated industries commission, 2005).</i></p> <p><i>- Double=declining-balance method equalizes the yearly burden on profit and loss account in respect of both depreciation and repairs.</i></p> <p><i>- This method charges heavy amount of depreciation in earlier years (Regulated industries commission, 2005).</i></p> <p><i>- The formula to obtain rate of depreciation can be applied only when there is residual value of the asset (Regulated industries commission, 2005).</i></p> <p><i>- The calculation in this method is more complex</i></p>

The amount of depreciation goes on decreasing while the expenses on repairs goes on increasing, so that the total charge against revenue over different years remains more or less the same (Regulated industries commission).

Source: Author

The useful life of assets

Rod Ellis and Patrick Callaghan have given the definition of useful life of asset as “The useful life of an asset is the life assigned to an asset for accounting purposes and is a measure of how long an asset is expected to continue to provide required service” (Rod, and Patrick, 2009).

Useful life of an asset is used in calculation depreciation of asset, which is used in straight-line depreciation method and double-declining-balance method and other depreciation methods.

Opportunity cost of land used

The opportunity costs are the benefits to be derived from using the resources in their best alternative uses (Drummond et al, 2005). Both opportunity cost of land used and stocked materials are counted in hospital cost analysis. In calculate the annual opportunity cost, the real interest rate of a 12-month fixed deposit in the year of analysis is used to perform the calculation (Creese, and Parker, 2000).

Annual opportunity cost of land = cost of land x real interest rate/100

Source: (Creese, and Parker, 2000)

Allocation Criteria Determination

Cost allocation Criteria

There are four main allocation criteria's to allocate the cost from one department to other department which include personnel criterion, cost criterion, patient criterion and service criterion (Supachutikul, 1997)

Personnel Criterion: it refers to the hospital staff, such as the number of employees working full-time or similar in a hospital, nursing or medical doctors.

Cost Criterion: it refers to the cost in each cost center, for example, wage, salary, material cost...

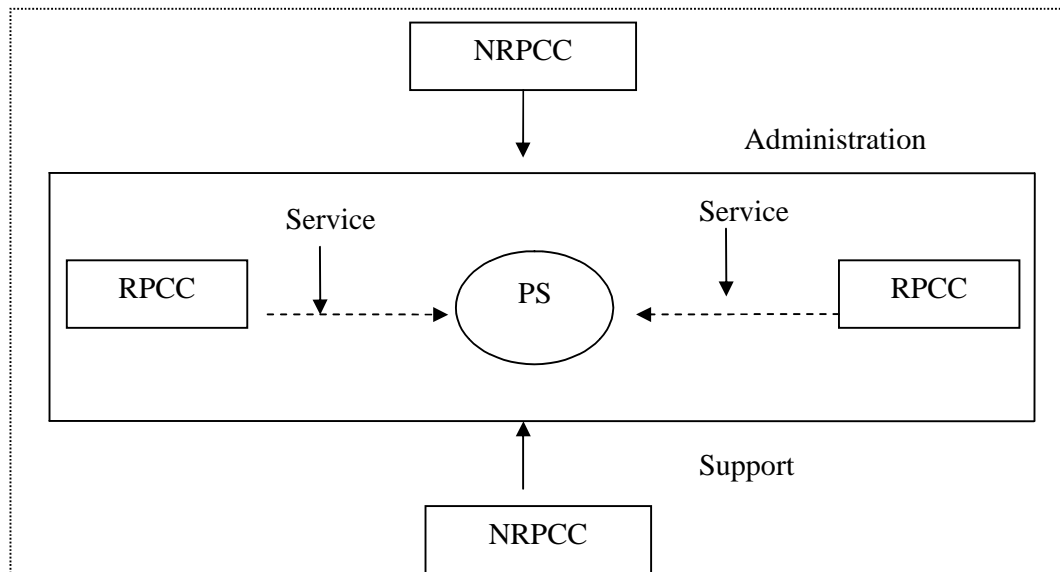
Patient Criterion: it relates to the patient, for example, the number of patient day and number of visit.

Service Criterion: it relates to general service of the hospital, for example, weight of the cloth used or occupied area and etc.

Indirect Cost Allocation

The indirect cost of non revenue producing cost center and revenue producing cost center will be allocated to patient service as following:

Figure 2.1 Cost allocation model



Source: Kamolratanakul, 2000

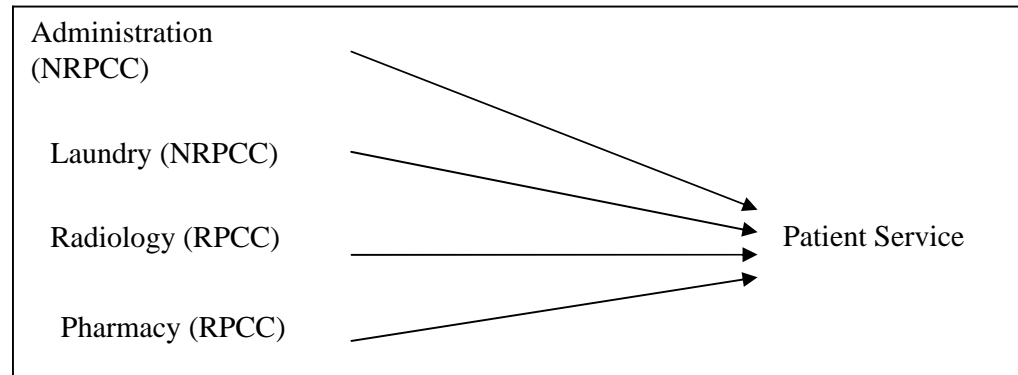
Figure 2.1 shows the way cost will be allocated among cost centers. In which cost of non revenue producing cost centers (NRPCC) which support and administrate patient service center (PS) will allocate to PS; Cost of revenue producing cost center which provide service to PS will allocate to PS.

There are four methods of cost allocation which are use in studies on unit cost

- Direct Distribution Method
- Step-Down Method
- Double Distribution Method (Double Apportionment)
- Simultaneous Equation Method

Direct Distribution Method. In this method, total cost of non revenue producing cost center and revenue producing cost center will be allocated directly to patient service and there is no cost allocation between non revenue producing cost center and revenue producing cost center as table below:

Figure 2.2 Direct distribution method



Source: (Viroj, et al, 2000)

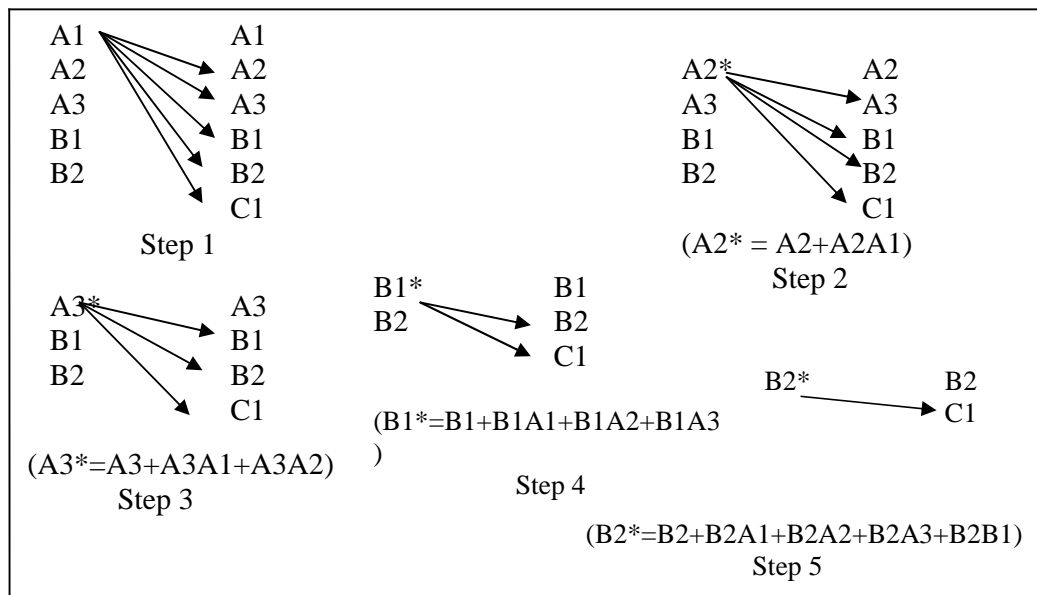
From figure 2.2 we can see that cost of NRPCC and RPCC will be allocated directly to PS and this is one way allocation. When NRPCC and RPCC allocate cost of themselves to PS, those cost centers will not have cost allocate back.

Step - down Method This method allocate cost from departments which are non revenue producing cost centers or overhead centers to other departments which are revenue producing cost centers and patient service centers, and this method also used to allocate cost from revenue producing cost center to patient service centers, this cost allocation is one-way cost allocation, i.e. If the cost of a department which has been allocated, there will not cost which returned to that department (Caplan, 2010).

Selecting the node department to allocate cost is very important. Sequence allocation of costs between non revenue producing cost centers and revenue producing cost centers will affect cost of patient service, whereby costs which are allocated to patient service will be increased or decreased when sequence changes. Therefore, the sequence of cost allocation is very important. Sequence of allocation is reasonable to start with the departments which provide the highest percentage of total

services of all departments, or departments provide services to almost all other departments, or other similar criteria (Caplan, 2010).

Figure 2.3 Step down cost allocation method



Source: (Viroj et al, 2000)

Figure 2.3 shows five steps in step down cost allocation method. In which, C1 is the last cost center which received cost of all cost centers.

Step 1, cost of cost center A1 will be allocated to all cost centers A2, A3, B1, B2, C1 (except A1) base on allocation criteria. After allocation, cost centers will have indirect cost comes from cost center A1.

Cost of cost center A2 (A2*) = direct cost of cost center A2+cost was allocated by cost center A1 to cost center A2.

Cost of cost center A3 = direct cost of cost center A3+ cost was allocated by cost center A1 to cost center A3

Cost of cost center B1 = direct cost of cost center B1+cost was allocated by cost center A1 to cost center B1

Cost of cost center B2 = direct cost of cost center B2+cost was allocated by cost center A1 to cost center B2

Cost of cost center C1=direct cost of cost center C1+cost was allocated by cost center A1 to cost center C1

After allocation, cost of cost center A1 will equal zero.

Step 2, Cost of cost center A2 (A2*) will be allocated to all cost centers A3, B1, B2, C1 (except A2) base on allocation criteria. After allocation, all cost centers have indirect cost comes from cost center A1 and cost center A2.

Cost of cost center A3(A3*) = direct cost of cost center A3+cost was allocated by cost center A1 to cost center A3+cost was allocated by cost center A2 to cost center A3

Cost of cost center B1=direct cost of cost center B1+cost was allocated by cost center A1 to cost center B1+cost was allocated by cost center A2 to cost center B1.

Cost of cost center B2=direct cost of cost center B2+cost was allocated by cost center A1 to cost center B2+cost was allocated by cost center A2 to cost center B2.

Cost of cost center C1=direct cost of cost center C1+cost was allocated by cost center A1 to cost center C1+cost was allocated by cost center A2 to cost center B2.

After allocation, cost of cost center A2 will equal zero.

Step 3, Cost of cost center A3 (A3*) will be allocated to all cost center B1, B2, C1 (except A3) base on allocation criteria. After allocation, all cost centers have indirect cost comes from cost center A1, cost center A2 and cost center A3.

Cost of cost center B1 ($B1^*$)=direct cost of cost center B1+ cost was allocated by cost center A1 to cost center B1+cost was allocated by cost center A2 to cost center B1+cost was allocated by cost center A3 to cost center B1.

Cost of cost center B2=direct cost of cost center B2+cost was allocated by cost center A1 to cost center B2+cost was allocated by cost center A2 to cost center B2+cost was allocated by cost center A3 to cost center B2.

Cost of cost center C1=Direct cost of cost center C1+cost was allocated by cost center A1 to cost center C1+cost was allocated by cost center A2 to cost center C1+cost was allocated by cost center A3 to cost center C1.

After allocation, cost of cost center A3 will equal zero

Step 4, cost of cost center B1 ($B1^*$) will be allocated to all cost center B2, C1 (except B1) base on allocation criteria. After allocation, all cost centers have indirect cost comes from cost center A1, cost center A2, cost center A3 and cost center B1.

Cost of cost center B2($B2^*$)=direct cost of cost center B2+cost was allocated by cost center A1to cost center B2+cost was allocated by cost center A2 to cost center B2+cost was allocated by cost center A3 to cost center B2+cost was allocated by cost center B1 to cost center B2.

Cost of cost center C1=direct cost of cost center C1+cost was allocated by cost center A1 to cost center C1+cost was allocated by cost center A2 to cost center C1+cost was allocated by cost center A3 to cost center C1+cost was allocated by cost center B1 to cost center C1.

After allocation, cost of cost center B1 will equal zero.

Step 5, cost of cost center B2 (B2*) will be allocated to cost center B1 base on allocation criteria. After allocation, C1 will have indirect cost comes from cost center A1, cost center A2, cost center A3, cost center B1 and cost center B2.

Cost of cost center C1=direct cost of cost center C1+cost was allocated by cost center A1 to cost center C1+cost was allocated by cost center A2 to cost center C1+cost was allocated by cost center A3 to cost center C1+cost was allocated by cost center B1 to cost center C1+cost was allocated by cost center B2 to cost center C1.

After allocation cost of cost center B2 will equal zero.

Example of stepdown cost allocation method

This is the example of using stepdown method in cost allocation. Data in table below is assumption with in 6 month. In which, Surgery, Obstretic and Pediatric are these last cost centers which received cost of all cost centers. And in this example, the first cost center will allocated cost to other cost center is administration.

Table 2.5 Data for using stepdown cost allocation method

Cost centers	Direct cost (USD)	Allocation criteria		
		No of staff	Space (m2)	No of telephone call
Administration	500	15	60	70
Finance	600	20	90	80
Cleaning	700	30	20	15
Security	500	10	20	100
IT	900	9	80	80
telecommunication	1000	10	90	300
Surgery	3000	24	150	50
Obstetric	4000	30	200	80
Pediatric	5000	39	250	70

Source: Author

First, administration will allocate cost to all cost center (except administration) base on number of staff (allocation criteria depends on assumption which is the best

for your calculation). After allocation, all of cost centers have indirect cost comes from Administration and cost of Administration will equal zero.

Table 2.6 Allocate cost of administration to other cost centers

<i>Cost centers</i>	<i>Direct cost</i> (1)	<i>% of staff</i> (2)	<i>Cost was allocated</i> (3)	<i>Total cost</i> 1(4)=(3)+(1)
<i>Administration</i>	500	0.00	0	0
<i>Finance</i>	600	0.12	58	658
<i>Cleaning</i>	700	0.17	87	787
<i>Security</i>	500	0.06	29	529
<i>IT</i>	900	0.05	26	926
<i>telecommunication</i>	1,000	0.06	29	1,029
<i>Surgery</i>	3,000	0.14	70	3,070
<i>Obstetric</i>	4,000	0.17	87	4,087
<i>Pediatric</i>	5,000	0.23	113	5,113
<i>Total cost</i>	16,200	1.00	500	16,200

Source: Author

Where

% of staff (2) = number staff of each cost center/total number of staff (except staff of administration)

Total number of staff = number staff of finance + number staff of cleaning + number staff of security + number staff of IT + number staff of telecommunication + number staff of surgery + number staff of obstetric + number staff of pediatric

Cost was allocated from administration to each cost center (3) = Direct cost of administration x % of staff of each cost center (2)

Total cost 1 (4) = Direct cost of each cost center (1) + cost was allocated from administration to each cost center (3).

Second, finance will allocate cost to all cost center (except finance) base on number of staff. After allocation, all of cost center have indirect cost comes from administration and finance; and cost of finance will equal zero.

Table 2.7 Allocate cost of finance to other cost centers

<i>Cost centers</i>	<i>Total cost 1(come from table 2.6)(1)</i>	<i>% of staff(2)</i>	<i>Cost was allocated(3)</i>	<i>Total cost 2 (4)=(3)+(1)</i>
<i>Administration</i>	0	0,00	0	0
<i>Finance</i>	658	0,00	0	0
<i>Cleaning</i>	787	0,20	130	917
<i>Security</i>	529	0,07	43	572
<i>IT</i>	926	0,06	39	965
<i>telecommunication</i>	1,029	0,07	43	1,072
<i>Surgery</i>	3,070	0,16	104	3,174
<i>Obstetric</i>	4,087	0,20	130	4,217
<i>Pediatric</i>	5,113	0,26	169	5,282
<i>Total cost</i>	16,200	1,00	658	16,200

Source: Author

Where

% of staff (2) = number staff of each cost center / total number of staff (except staff of administration and finance)

Total number of staff = number staff of cleaning + number staff of security + number staff of IT + number staff of telecommunication + number staff of surgery + number staff of obstetric + number staff of pediatric

Cost was allocated from finance to each cost center (3) = Cost of finance x % of staff of each cost center (2)

Cost of finance = direct cost of finance + cost was allocated from administration to finance

Total cost 2 (4) = Total cost 1 of each cost center (1) + cost was allocated from finance to each cost center (3)

Third, cleaning will allocate cost to other cost centers (except cleaning) based on space. After allocation, all cost centers have indirect cost comes from administration, finance and cleaning; and cost of cleaning will equal zero.

Table 2.8 Allocate cost of cleaning to other cost centers

<i>Cost centers</i>	<i>Total cost 2 (come from table 2.7)(1)</i>	<i>% of space (2)</i>	<i>Cost was allocated(3)</i>	<i>Total cost 3 (4)=(3)+(1)</i>
<i>Administration</i>	0	0,00	0	0
<i>Finance</i>	0	0,00	0	0
<i>Cleaning</i>	917	0,00	0	0
<i>Security</i>	572	0,03	23	596
<i>IT</i>	965	0,10	93	1,058
<i>telecommunication</i>	1,072	0,11	104	1,177
<i>Surgery</i>	3,174	0,19	174	3,348
<i>Obstetric</i>	4,217	0,25	232	4,449
<i>Pediatric</i>	5,282	0,32	290	5,572
<i>Total cost</i>	16,200	1,00	917	16,200

Source: Author

Where

% of space (2) = space of each cost center / total space (except space of administration, finance and cleaning)

Total space = space of security + space of IT + space of telecommunication + space of surgery + space of obstetric + space of pediatric

Cost was allocated from cleaning to each cost center (3) = Cost of cleaning x % of space of each cost center (2)

Cost of cleaning = direct cost of cleaning + cost was allocated from administration to cleaning + cost was allocated from finance to cleaning

Total cost 3 (4) = Total cost 2 (1) + cost was allocated by cleaning to each cost center (3)

Forth, security will allocate cost to other cost centers (except security) base on number of staff. After allocation all cost centers have indirect cost comes from administration, finance, cleaning, security; cost of security will equal zero

Table 2.9 Allocate cost of security to other cost centers

<i>Cost centers</i>	<i>Total cost 3 (come from table 2.8)(1)</i>	<i>% of staff (2)</i>	<i>Cost was allocated(3)</i>	<i>Total cost 4 (4)=(3)+(1)</i>
<i>Administration</i>	0	0.00	0	0
<i>Finance</i>	0	0,00	0	0
<i>Cleaning</i>	0	0.00	0	0
<i>Security</i>	596	0.00	0	
<i>IT</i>	1,058	0.08	48	1,106
<i>telecommunication</i>	1,177	0.09	53	1,230
<i>Surgery</i>	3,348	0.21	128	3,475
<i>Obstetric</i>	4,449	0.27	160	4,609
<i>Pediatric</i>	5,572	0.35	207	5,780
<i>Total cost</i>	16,200	1.00	596	16,200

Source: Author

Where

% of staff (2) = number staff of each cost center / total number of staff (except administration, finance, cleaning, security)

Total number of staff = number staff of IT + number staff of telecommunication + number staff of surgery + number staff of obstetric + number staff of pediatric

Cost was allocated from security to each cost center = cost of security x % of staff of each cost center (2)

Cost of security = direct cost of security + cost was allocated from administration to security + cost was allocated from finance to security + cost was allocated from cleaning to security

Total cost 4 (4) = total cost 3 (1)+ cost was allocated from security to each cost center (3)

Fifth, IT will allocate cost to other cost center (except administration, finance, cleaning, security and IT) base on number of staff. After allocation, all cost centers have indirect cost comes from administration, finance, cleaning, security and IT; cost of IT will equal zero.

Table 2.10 Allocate cost of IT to other cost centers

<i>Cost centers</i>	<i>Total cost 4(come from table 2.9) (1)</i>	<i>% of staff (2)</i>	<i>Cost was allocated (3)</i>	<i>Total cost 5(4)=(3)+(1)</i>
<i>Administration</i>	0	0.00	0	0
<i>Finance</i>	0	0.00	0	0
<i>Cleaning</i>	0	0.00	0	0
<i>Security</i>	0	0.00	0	0
<i>IT</i>	1,106	0.00	0	0
<i>telecommunication</i>	1,230	0.10	107	1,337
<i>Surgery</i>	3,475	0.23	258	3,733
<i>Obstetric</i>	4,609	0.29	322	4,931
<i>Pediatric</i>	5,780	0.38	419	6,199
<i>Total cost</i>	16,200	1.00	1,106	16,200

Source: Author

Where

% of staff (2) = number staff of each cost center / total number of staff (except administration, finance, cleaning, security and IT)

Total number of staff = number staff of telecommunication + number staff of surgery + number staff of obstetric + number staff of pediatric

Cost was allocated from IT to each cost center (3) = cost of IT x % of staff of each cost center (2)

Cost of IT = direct cost of IT + cost was allocated from administration to IT + cost was allocated from finance to IT + cost was allocated from cleaning to IT + cost was allocated from security to IT

Total cost 5 (4)= total cost 4 (1) + cost was allocated from IT to each cost center (3)

Sixth, telecommunication will allocate cost to other cost center (except administration, finance, cleaning, security, IT and telecommunication) base on number of telephone call. After allocation, surgery, obstetric and pediatric have indirect cost comes from administration, finance, cleaning, security, IT and telecommunication. Cost of telecommunication will equal zero.

Table 2.11 Allocate cost of telecommunication to other cost centers

<i>Cost centers</i>	<i>Total cost 5 (come from table 2.10)(1)</i>	<i>% of telephone call(2)</i>	<i>Cost was allocated(3)</i>	<i>Total cost 6(4)=(3)+(1)</i>
<i>Administration</i>	0	0.00	0	0
<i>Finance</i>	0	0.00	0	0
<i>Cleaning</i>	0	0.00	0	0
<i>Security</i>	0	0.00	0	0
<i>IT</i>	0	0.00	0	0
<i>telecommunication</i>	1,337	0.00	0	0
<i>Surgery</i>	3,733	0.25	334	4,067
<i>Obstetric</i>	4,931	0.40	535	5,466
<i>Pediatric</i>	6,199	0.35	468	6,667
<i>Total cost</i>	16,200	1.00	1,337	16,200

Source: Author

Where

% of telephone call (2) = number telephone call of each cost center / total number of telephone call (except administration, finance, cleaning, security, IT and telecommunication)

Total number of telephone call = number telephone call of surgery + number telephone call of

Cost was allocate = cost of telecommunication x % of telephone call of each cost center (2)

Total cost 6 (4) = total cost 5 (1) + cost was allocated by telecommunication to each cost center (3)

After allocation, we will have the final total cost of three last cost centers. And combine all of table of using step down cost allocation method we can have table 2.12. At table 2.12 we can see that cost of each cost center after allocation will equal zero; final cost centers will have indirect cost comes from all of cost centers which allocated cost to them; and total cost of all cost centers are remain stable.

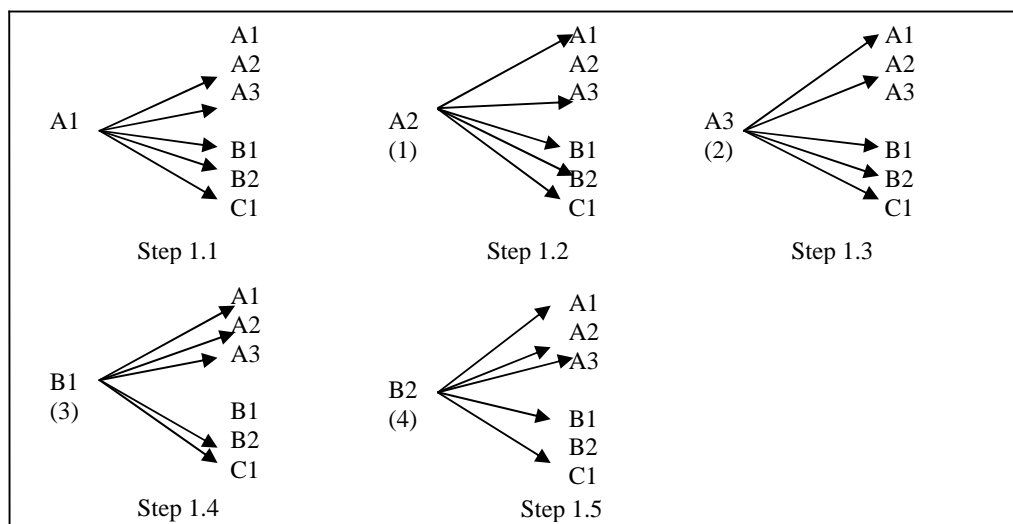
Table 2.12 Step down cost allocation method

<i>Cost centers</i>	<i>Total cost 1 (from table 2.6)</i>	<i>Total cost 2 (from table 2.7)</i>	<i>Total cost 3 (from table 2.8)</i>	<i>Total cost 4 (from table 2.9)</i>	<i>Total cost 5 (from table 2.10)</i>	<i>Total cost 6 (from table 2.11)</i>
<i>Administration</i>	0	0	0	0	0	0
<i>Finance</i>	658	0	0	0	0	0
<i>Cleaning</i>	787	917	0	0	0	0
<i>Security</i>	529	572	596	0	0	0
<i>IT</i>	926	965	1,058	1,106	0	0
<i>telecommunication</i>	1,029	1,072	1,177	1,230	1,337	0
<i>Surgery</i>	3,070	3,174	3,348	3,475	3,733	4,067
<i>Obstetric</i>	4,087	4,217	4,449	4,609	4,931	5,466
<i>Pediatric</i>	5,113	5,282	5,572	5,780	6,199	6,667
<i>Total cost</i>	16,200	16,200	16,200	16,200	16,200	16,200

Source: Author

Double Distribution Method: This method can overcome some of the weakness in the step down method which allocates the cost base on the true relation of service and support provided among the departments. However, this method seems to be more complex than step-down method. There are two steps in this method. Firstly cost of every cost centers in non revenue producing cost center group and revenue producing cost center will be allocated to patient service and among each other. Secondly, after the cost was allocated, the step-down method will be used to allocate cost from non revenue producing cost center and revenue producing cost center to patient service.

Figure 2.4 First step in double distribution method



Source: Viroj et al, 2000

First step in double distribution method will be described as follow:

Step 1.1, cost of cost center A1 will be allocated to all cost centers A2, A3, B1, B2, C1 (except A1) base on allocation criteria. After allocation, cost of cost centers will be:

Cost of cost center A2 (1) = direct cost of cost center A2 + cost was allocated from cost center A1 to cost center A2

Cost of cost center A3 = direct cost of cost center A3 + cost was allocated from cost center A1 to cost center A3

Cost of cost center B1 = direct cost of cost center B1 + cost was allocated from cost center A1 to cost center B1

Cost of cost center B2 = direct cost of cost center B2 + cost was allocated from cost center A1 to cost center B2

Cost of cost center C1 = direct cost of cost center C1 + cost was allocated from cost center A1 to cost center C1

After allocation cost of cost center A1 will equal zero

Step 1.2 cost of cost center A2 (1) will be allocated to all cost centers A1, A3, B1, B2, C1 (except A2) base on allocation criteria. After allocation, cost of cost centers will be:

Cost center A1 = cost was allocated from cost center A2 to cost center A1

Cost center A3 (2) = direct cost of cost center A3 + cost was allocated from cost center A1 to cost center A3 + cost was allocated from cost center A2 to cost center A3

Cost center B1 = direct cost of cost center B1 + cost was allocated from cost center A1 to cost center B1 + cost was allocated from cost center A2 to cost center B1

Cost center B2 = direct cost of cost center B2 + cost was allocated from cost center A1 to cost center B2 + cost was allocated from cost center A2 to cost center B2

Cost center C1 = direct cost of cost center C1 + cost was allocated from cost center A1 to cost center C1 + cost was allocated from cost center A2 to cost center C1

After allocation, cost of cost center A2 will equal zero

Step 1.3 cost of cost center A3 (2) will be allocated to all cost centers A1, A2, B1, B2, C1 (except A3) base on allocation criteria. After allocation, cost of cost centers will be:

Cost of cost center A1 = cost was allocated from cost center A2 to cost center A1 + cost was allocated from cost center A3 to cost center A1

Cost of cost center A2 = cost was allocated from cost center A3 to cost center A2

Cost of cost center B1(3) = direct cost of cost center B1 + cost was allocated from cost center A1 to cost center B1+ cost was allocated from cost center A2 to cost center B1 + cost was allocated from cost center A3 to cost center B1

Cost of cost center B2 = direct cost of cost center B2 + cost was allocated from cost center A1 to cost center B2 + cost was allocated from cost center A2 to cost center B2 + cost was allocated from cost center A3 to cost center B2

Cost of cost center C1 = direct cost of cost center C1 + cost was allocated from cost center A1 to cost center C1+ cost was allocated from cost center A2 to cost center C1 + cost was allocated from cost center A2 to cost center C1

After allocation cost of cost center A3 will equal zero

Step 1.4 cost of cost center B1 (3) will be allocated to all cost center A1, A2, A3, B2, C1 (except B1) base on allocation criteria. After allocation, cost of cost centers will be:

Cost of cost center A1 = cost was allocated from cost center A2 to cost center A1 + cost was allocated from cost center A3 to cost center A1 + cost was allocated from cost center B1 to cost center A1

Cost of cost center A2 = cost was allocated from cost center A3 to cost center A2 + cost was allocated from cost center B1 to cost center A2

Cost of cost center A3 = cost was allocated from cost center B1 to cost center A3

Cost of cost center B2 (4) = direct cost of cost center B2 + cost was allocated from cost center A1 to cost center B2 + cost was allocated from cost center A2 to cost center B2 + cost was allocated from cost center A3 to cost center B2 + cost was allocated from cost center B1 to cost center B2

Cost of cost center C1 = direct cost of cost center C1 + cost was allocated from cost center A1 to cost center C1 + cost was allocated from cost center A2 to cost center C1 + cost was allocated from cost center A3 to cost center C1 + cost was allocated from cost center B1 to cost center C1

After allocation, cost of cost center B1 will equal zero

Step 1.5 cost of cost center B2 (4) will be allocated to all cost center A1, A2, A3, B1, C1 (except B2) base on allocation criteria. After allocation, cost of cost centers will be:

Cost of cost center A1(A1*) = cost was allocated from cost center A2 to cost center A1 (A2A1) + cost was allocated from cost center A3 to cost center A1(A3A1) + cost was allocated from cost center B1 to cost center A1 (B1A1) + cost was allocated from cost center B2 to cost center A1 (B2A1)

Cost of cost center A2 = cost was allocated from cost center A3 to cost center A2 (A3A2) + cost was allocated from cost center B1 to cost center A2 (B1A2)+ cost was allocated from cost center B2 to cost center A2 (B2A2)

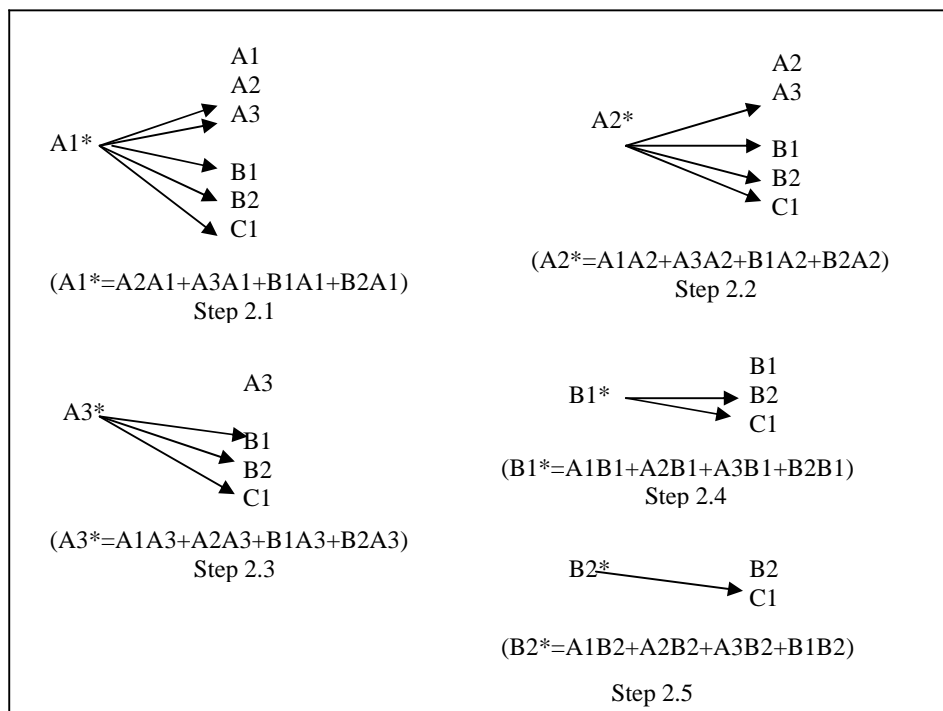
Cost of cost center A3 = cost was allocated from cost center B1 to cost center A3 (B1A3) + cost was allocated from cost center B2 to cost center A3 (B2A3)

Cost of cost center B1 = cost was allocated from cost center B2 to cost center B1 (B2B1)

Cost of cost center C1 = direct cost of cost center C1 + cost was allocated from cost center A1 to cost center C1 (A1C1) + cost was allocated from cost center A2 to cost center C1 (A2C1) + cost was allocated from cost center A3 to cost center C1 (A3C1) + cost was allocated from cost center B1 to cost center C1 (B1C1) + cost was allocated from cost center B2 to cost center C1 (B2C1)

After allocation cost of cost center B2 will equal zero

Figure 2.5 Second step in double distribution method



Source: Viroj, et al, 2000

Second step in double distribution method is explained similar with step-down method. In which C1 is the last cost center which received cost of all cost center. Second step in double distribution will be described below:

Step 2.1 cost of cost center A1 (A1*) will be allocated to all cost center A2, A3, B1, B2, C1 base on allocation criteria. After allocation, cost centers will have indirect cost comes from cost center A1*:

Cost of cost center A2 (A2*) = cost was allocated from cost center A1* to cost center A2 (A1A2) + A3A2 + B1B2 + B2B2

Cost of cost center A3 = cost was allocated from cost center A1* to cost center A3 (A1A3) + B1B3 + B2B3

Cost of cost center B1 = cost was allocated from cost center A1* to cost center B1 (A1B1) + B2B1

Cost of cost center B2 = cost was allocated from cost center A1* to cost center B2 (A1B2)

Cost of cost center C1 = cost was allocated from cost center A1* to cost center C1 (A1*C1) + A1C1 + A2C1 + A3C1 + B1C1 + B2C1 + direct cost of cost center C1

After allocation cost of cost center A1* will equal zero

Step 2.2 cost of cost center A2 (A2*) will be allocated to all cost centers A3, B1, B2, C1 base on allocation criteria. After allocation, cost centers will have indirect cost comes from cost center A1* and cost center A2*

Cost of cost center A3 (A3*) = cost was allocated from cost center A2* to cost center A3 (A2A3) + A1A3 + B1B3 + B2B3

Cost of cost center B1 = cost was allocated from cost center A2* to cost center B1 (A2B1) + A1B1 + B2B1

Cost of cost center B2 = cost was allocated from cost center A2* to cost center B2 (A2B2) + A1B2

Cost of cost center C1 = cost was allocated from cost center A2* to cost center C1 (A2*C1) + A1*C1 + A1C1 + A2C1 + A3C1 + B1C1 + B2C1 + direct cost of cost center C1

After allocation, cost of cost center A2* will equal zero

Step 2.3 cost of cost center A3 (A3*) will be allocated to all cost centers B1, B2, C1 base on allocation criteria. After allocation, cost centers will have indirect cost comes from cost center A1*, cost center A2* and cost center A3*.

Cost of cost center B1 (B1*) = cost was allocated from cost center A3* to cost center B1 (A3B1) + A2B1 + A1B1 + B2B1

Cost of cost center B2 = cost was allocated from cost center A3* to cost center B2 (A3B2) + A2B2 + A1B2

Cost of cost center C1 = cost was allocated from cost center A3* to cost center C1 (A3*C1) + A2*C1 + A1*C1 + A1C1 + A2C1 + A3C1 + B1C1 + B2C1 + direct cost of cost center C1

After allocation, cost of cost center A3* will equal zero

Step 2.4 cost of cost center B1 (B1*) will be allocated to cost centers B2, C1 base on allocation criteria. After allocation, B2 and C1 will have indirect cost comes from cost center A1*, cost center A2*, cost center A3* and cost center B1*.

Cost of cost center B2 (B2*) = cost was allocated from cost center B1* to cost center B2 (B1B2) + A3B2 + A2B2 + A1B2

Cost of cost center C1 = cost was allocated from cost center B1* to cost center C1 (B1*C1) + A3*C1 + A2*C1 + A1*C1 + A1C1 + A2C1 + A3C1 + B1C1 + B2C1 + direct cost of cost center C1

After allocation, cost of cost center B1* will equal zero

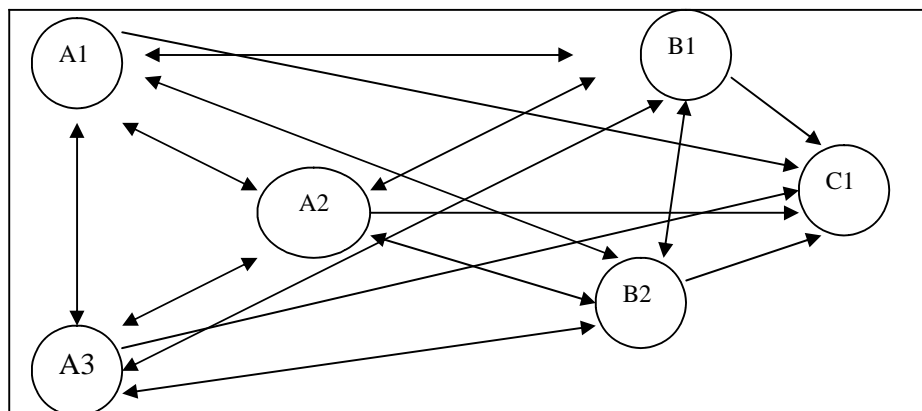
Step 2.5 cost of cost center B2 (B2*) will be allocated to cost center C1 base on allocation criteria. After allocation, C1 will have indirect cost comes from cost center A1*, cost center A2*, cost center A3*, cost center B1* and cost center B2*

Cost of cost center C1 = cost was allocated from cost center B2* to cost center C1 (B2*C1) + B1*C1 + A3*C1 + A2*C1 + A1*C1 + A1C1 + A2C1 + A3C1 + B1C1 + B2C1 + direct cost of cost center C1

After allocation cost of cost center B2* will equal zero

Simultaneous Equation Method: This method use the same data with step-down method, but it solves a set of simultaneous linear equations to give the allocation (Drummond et al, 2005).

Figure 2.6 Simultaneous Equation Method



Source: Viroj, et al, 2000

Figure 2.6 shows the process of simultaneous equation method. In which cost center C1 is the last cost center which received cost of all cost centers. All of cost centers will allocated cost together and use simultaneous linear equation to allocate. From this figure, cost of cost center A1 will be allocated to cost centers A2, A3, B1, B2, C1 and this cost center will also receive costs come from cost centers A2, A3, B1, B2. Cost of cost center A2 will be allocated to cost centers A1, A3, B1, B2, C1 and this cost center will also receive costs come from cost centers A1, A3, B1, B2. Cost of cost center A3 will be allocated to cost centers A1, A2, B1, B2, C1 and this cost center will also receive costs come from cost centers A1, A2, B1, B2. Cost of cost center B1 will be allocated to cost centers A1, A2, A3, B2, C1 and this cost center will also receive costs come from cost centers A1, A2, A3, B2. Cost of cost center B2 will be allocated to cost centers A1, A2, A3, B1, C1 and this cost center will also receive costs come from cost centers A1, A2, A3, B1.

Compared to the simultaneous equation, the direct allocation method and step - down allocation method are more simple, but sometimes the step - down method is quite complex. However, simultaneous equation method is not widely used because the calculation used in this method is very complicate. Under the development of computer technology, simultaneous equation method has become more accessible. In fact many companies do not allocate the full cost of services, because they did not think the distribution of these benefits, or because they do not believe that the benefits could justify the costs (Caplan, 2010)

Table 2.13 Cost allocation methods comparison

<i>Cost allocation</i>	<i>Definition</i>	<i>Calculation</i>	<i>Strength</i>	<i>Weakness</i>
<i>Direct</i>	<i>The cost of each over head is allocated directly to final cost center</i>	<i>- Simple</i>	<i>No interaction between overhead cost centers prior to allocation that why this method is simple and easy to complement</i> <i>- Reliability is not high</i>	<i>- Misstates opportunity cost</i> <i>In this method, cost centers do not allocate cost together as simultaneous equation method, Therefore, some cost centers were not used in their best alternative use in cost allocation</i> <i>- Ignore mutual services provided among all cost centers</i>
<i>Step-down</i>	<i>The cost of each over head cost center is allocated in a step-wise fashion to all of the other overhead departments and to the final</i>	<i>Simple</i>	<i>- More complicate than direct cost</i> <i>- Reduce the subsidization of service center use of other service center</i> <i>- Good reliability</i>	<i>- Misstates opportunity cost</i> <i>In this method, cost centers do not allocate cost together as simultaneous equation method, Therefore, some cost centers were</i>

	<i>cost center</i> (Shepard, Hodgkin, and Anthony, 2000)			<i>not used in their best alternative use in cost allocation Selection of which department is allocated first will affect the result - ignore mutual services provided among all service centers</i>
<i>Double distribution</i>	<i>The cost is allocated among all cost center and then the cost of overhead cost center is allocated in a step wise fashion to all of the other overhead departments and to the final cost center</i>	<i>More complex</i>	<i>- More complicate than step-down method - Better reliability</i>	<i>- Misstate opportunity cost In this method, cost centers do not allocate cost together as simultaneous equation method, Therefore, some cost centers were not used in their best alternative use in cost allocation Selection of which</i>

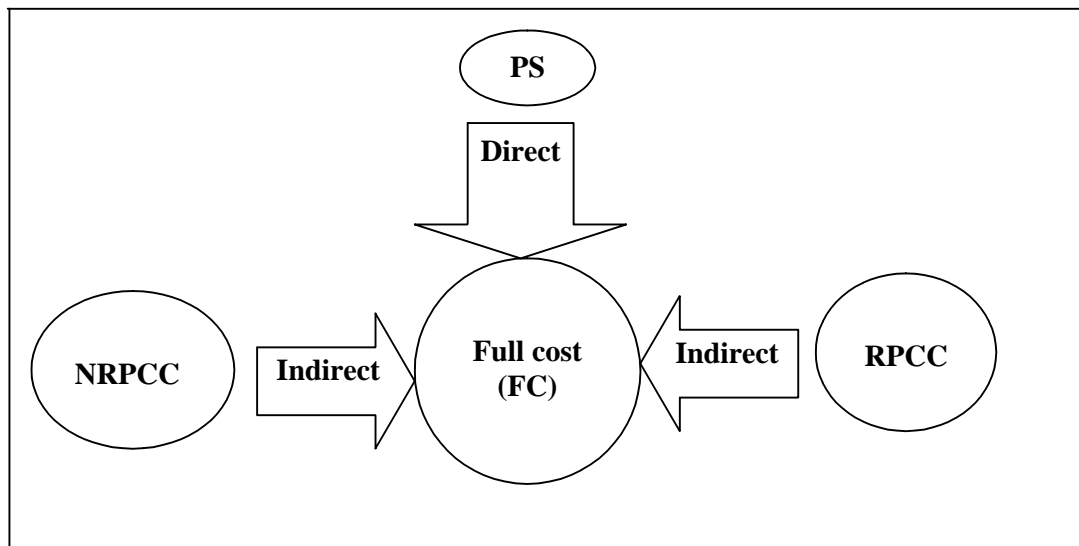
				<i>department is allocated first will affect the result</i>
<i>Simultaneous equation</i>	<i>Gives full recognition to interdepartmental services. Allocate cost among cost centers in both directions. This method requires the use of simultaneous equations</i>	<i>The most complex</i>	<i>- The most complicated method - The most reliability - Theoretically correct method of allocating costs - Closest measurement of opportunity cost - consider about mutual services provided among all service department</i>	<i>- Seldom used because math is misunderstood - Assumes all costs are variable, fixed costs should be allocated based on expected use</i>

Source: Author

Full Cost Determination

The full cost of patient service centers is the total cost of indirect cost comes from direct cost of non revenue producing cost, indirect cost comes from cost of revenue producing cost center (which include indirect cost come from direct cost of non revenue producing cost center and direct cost of revenue producing cost center) and direct cost of patient service as shown in Figure 2.7.

Figure 2.7 Full cost determination



Source: (Kamolratanakul, 2000)

$$\text{Full Cost (PS)} = \text{Direct Cost (DC)} + \text{Indirect Cost (IDC)}$$

$$= \text{DC (PS)} + \text{IDC (NRPCC)} + \text{IDC (RPCC)}$$

$$= \text{Total Direct Cost from Patient Service Area (PS)} + \text{Indirect Cost from direct cost of Non-Revenue Producing Cost Center (NRPCC)} + \text{Indirect Cost from cost of Revenue Producing Cost Center (RPCC) which is include direct cost of RPCC and indirect cost come from direct cost of NRPCC}$$

Unit Cost Calculation

After having full cost of patient service, the unit cost of patient service will be calculated by dividing full cost of patient service area to number of patient service unit.

$$\text{Unit cost of patient service} = \frac{\text{Full cost of patient service area}}{\text{Number of patient service unit}}$$

Source: (Kamolratanakul, 2000)

For inpatient service, number of patient service unit will be the number of inpatient days (Patcharanarumol, Tisayaticom, and Viroj, 2001).

Figure 2.8 Unit cost calculation

$$\text{Unit cost of in – patient service} = \frac{\text{Full cost of in-patient service}}{\text{Number of in-patient or patient days}}$$

$$\text{Unit cost (IPD)} = \frac{\text{Full Cost (PS)}}{\text{Number of Patient Days}}$$

Source: Kamolratanakul, 2000

2.6 Applying cost analysis in worldwide and Vietnam

Cost analysis research in the world and Vietnam

In 2010, a research about unit costs of inpatient hospital days, outpatient visits and daycare treatment was conducted in Netherlands. Ordinary least squares regression models were constructed to examine the degree of association between unit costs and hospital and hospital department characteristics. All costs were based on Euro 2007 cost data. At university hospitals, the unit costs per inpatient day were determined at €633 in oncology and €680 in hematological departments. At general hospitals, the mean costs per inpatient day were €400. Unit costs for inpatient hospital days, outpatient visits. And daycare treatments equaled the relative ratio 100:21:44. Direct labor costs were the major cost driver and the type of hospital was a strong predictor of unit costs (Tan, 2010).

In 2008, the research on “Direct and Indirect Costs of Fractures due to Osteoporosis in Austria” was carried out in Austria. This research aim to examined the financial burden of osteoporosis in Austria. For the research method, this study took both direct and indirect costs into consideration. In which, direct costs encompass medical costs such as expenses for pharmaceuticals, inpatient and outpatient medical care costs, as well as other medical services, this study also mentioned about non – medical direct costs which include transportation costs and medical devices. And also Indirect cost was mentioned which refer to costs of productivity losses due to absence of work. This study also included costs for early retirement and opportunity costs of informal care provided by family members. For data analysis, this study combined data of official statistics, expert estimates as well as unique patient surveys conducted in the course of an international osteoporotic fracture study in 2008 in Austria. The result of this study shows that the total annual costs in the year 2008 imposed by osteoporosis in Austria is 707.4 million € and the largest fraction of this amount is incurred by acute hospital treatment. This study also shows that accounting for 29% of total costs is the opportunity cost of informal care. Result comes from this study also shows that the financial burden of osteoporosis in Austria is substantial. And the research also shows that the information of this research is needed to inform health policy decision makers (Dimai et al, 2012).

In 2009, Javanbakht and other authors carried out the research on “Cost of illness analysis of type 2 diabetes mellitus in Iran”. The aim of this research is to provide a detailed economic burden of diagnosed type 2 diabetes mellitus (T2DM) and its complication in Iran in 2009. For research method, this is a prevalence – based cost – of – illness study focusing on quantifying direct health care costs by bottom –

up – approach. Data was collected in this research was inpatient hospital services, outpatient clinic visits, physician services, drugs, laboratory test, education and non-medical cost were collected from two national registries. And in this research, the human capital approach was used to calculated indirect costs separately in male and female and also among different age groups. The result of this study shows that total national cost of diagnosed T2DM in 2009 was US\$ 3.78 billion and indirect costs was US\$ 1.73 million. This research also estimated that the complications (48,9%) and drugs (23,8%) were main components of direct cost and the largest components of medical expenditures attributed to diabetes's complications are cardiovascular disease (42,3% of total Complications cost), nephropathy (23%) and ophthalmic complications (14%). Indirect cost was mentioned in the research, in which indirect cost include temporarily disability (US\$ 335.7 million), permanent disability (US\$ 452.4 million) and reduced productivity due to premature mortality (US\$ 950.3 million). For the conclusion, the reseach shows that T2DM is a costly disease in the Iran healthcare system and consume more than 8.69% of total health expenditure, and T2DM imposes high intangible costs on society in terms of reduced quality of life (Javanbakht et al, 2011).

Previous hospital cost study in Vietnam

There have been several previous studies which measured hospital costs in Viet Nam. In 2004, the research on “Costs of service of Vietnamese hospitals: Identifying costs in one central, two provincial and two district hospital using a standard methodology” was carried out in Vietnam by Dung and Flessa. The objective of this method is to analyze the average cost as well as the main cost drivers of five hospitals in Vietnam. Method was use in this method was estimate the full cost of five

hospitals, including depreciation and the value of donations, step-down method was applied in this study. The result of this study shows that the average costs per inpatient at the central hospital are about 300% of the cost of provincial hospitals and about 600% of the costs of district hospitals. The result also shows that the costs of some laboratory procedures and operations done at district hospitals are higher than those of provincial or even central hospitals, and the main reason for the high costs of some procedures at district hospitals was the low quantity of the procedures at that level (Dung, and Flessa, 2004).

The research named “Costing of clinical service in rural district hospital in northern Vietnam” was carried out by Minh, HV and other authors in 2010. This research aimed to estimate and analyse the “actual” unit cost of providing key clinical services in selected rural district hospital in the North of Vietnam. In other hand, this research also examined the relationship between actual costs and the levels of cost covered by the corresponding user fees paid by patients. The research method of this study was a facility – based costing study which estimates the costs of health care services from the perspective of the service providers. This research included three rural district hospitals from three provinces in the North of Vietnam, and using step-down method for allocating cost. The result of this research shows that there were a little difference in the costs of an outpatient visit across the hospitals, but the cost of an operation and an inpatient day varied considerably. And this research also found that, in terms of cost structure, personnel costs accounted for the highest share of total cost of the clinical services. The result of this study also mentioned that the shares of operating cost were considerable while depreciation of buildings/equipments made up a small “proportion”. And one more important thing in the result of this research is the

user fee levels were much lower than the actual costs of providing the corresponding services (Minh, et al, 2010)

Cost analysis research on renal disease in the world

Patients with end-stage renal kidney failure have increased dramatically in Indonesia. Chronic glomerulonephritis is the leading cause of this disease, in addition to the number of diabetes patients also increased significantly. The data presented in this study were collected from the urology centers to answer specific questions give by the Assembly Nephrology Indonesia. These data showed that prevalence and incidence in Bali and Java are increasing over time, although this rate is lower than expected. Hemodialysis has been common in all parts of the country. Peritoneal dialysis and kidney transplant have been made in some centers. The cost of dialysis and kidney transplantation is still very high and most patients cannot afford to pay. Due to the cost burden, medical care services should focus on disease prevention (Prodjosudjadi, 2006)

In 2001, a research on “prevalence and direct medical costs of end – stage renal disease in patients with type 2 diabetes mellitus in Switzerland for 2001” was carried out in Switzerland. The purpose of this study is to analyze the prevalence and direct medical costs in the insurance funds in Switzerland have been identified for end-stage renal patients with two types of diabetes. The rate is determined based on cross-sectional retrospective analysis, including all dialysis centers and renal transplantation centers in Switzerland. Costs were calculated separately for the three treatments of end-stage renal failure - hemodialysis, peritoneal dialysis and kidney transplant. Costs were calculated based on rates of the study subjects who received one of three treatments. Data from the Swiss Union for the social Duties of the

Insurance Funds (SVK) have been used for all three treatments. SVK has no data for kidney transplantation, and data on health resources have been identified using questionnaires to interview the experts by phone. Cross-sectional study of dialysis centers and renal transplantation have sufficient data. In Switzerland in 2001, the percentage of end-stage renal failure in patients with two types of DM up to 73.0 million people. The total direct medical costs of the disease are up to CHF 46,065,788 equal US\$ 50066141 (accounting for 0.1% of total health expenditure). Including CHF 1570 per 100,000 people per day, 81.6% of these costs for hemodialysis, peritoneal dialysis accounted for 7.1% and 11.4% for the kidney transplant. The cost of treating end-stage renal failure is CHF 215 per patient per day (Sandoz et al, 2001).

CHAPTER III

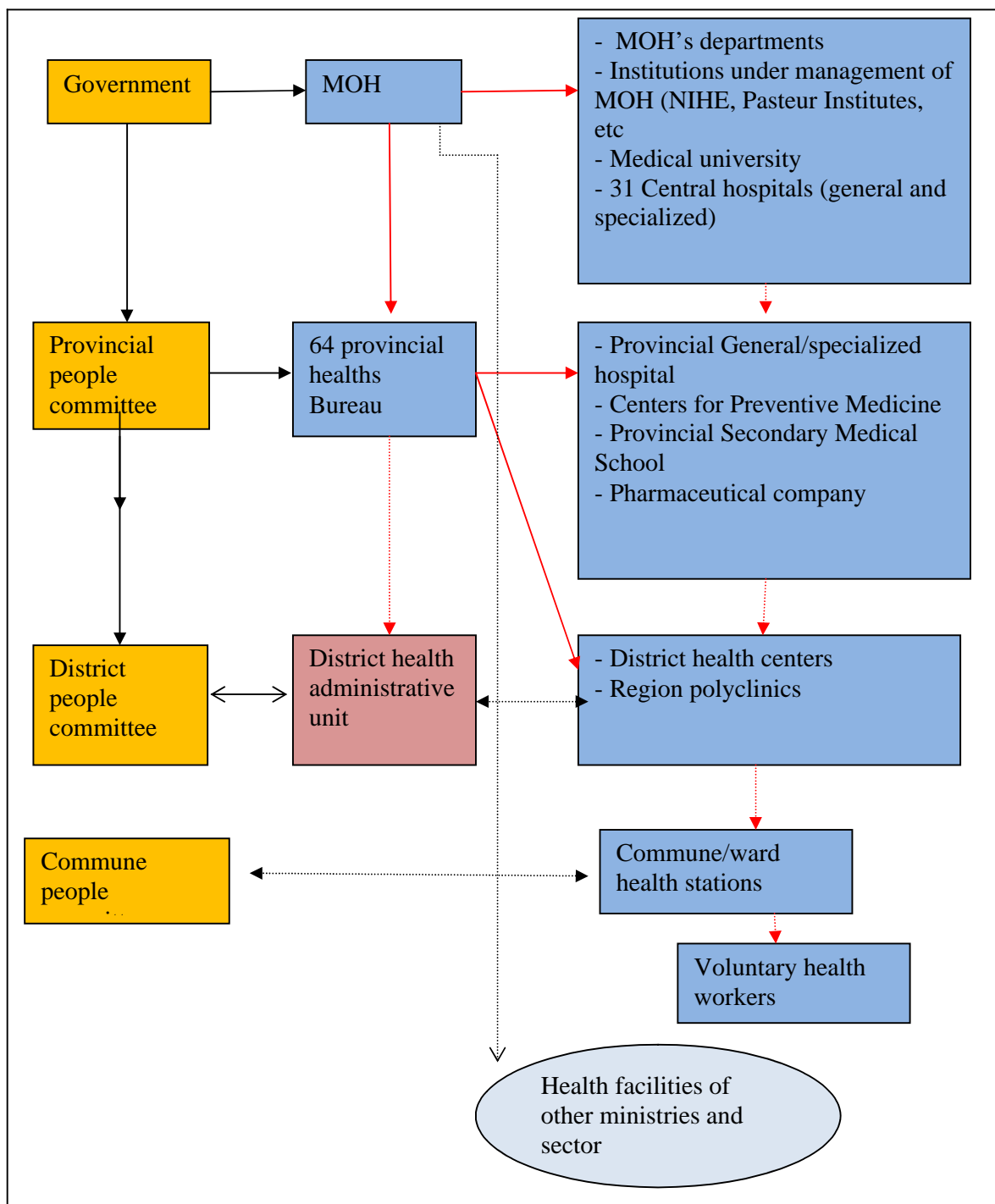
BACK GROUND

This part will provide an overview about research subject, health care system and health financing system of Vietnam.

3.1 Public health system structure

At the present, Vietnam health system was divided into three levels. The first level, called central level is managed by Ministry of Health (MoH). The second level is provincial level (provincial health service departments or PHDs) that is technically managed by MoH and financially managed by Provincial Committee. The third level is district level (district health offices or DHOs). As the provincial level it is managed by both Provincial Health Service and District people committee. Commune Health Stations and Commune Health workers are considered as grassroots level and are managed technically by district health service and commune people committee. The figure below described specifically health system structure of Vietnam and the management among levels (USAID and Health Strategy and Policy Institute, 2009):

Figure 3.1 Structure of public health care system in Vietnam



Source: USAID and Health Strategy and Policy Institute, 2009

Generally, the structure of public health care system in Vietnam is quite well and has wide coverage. However, the application of partial user-fee has allowed patients to asset the best hospital. The most common problem is people prefer the provincial and central levels to district and commune level, therefore the hospital overload issue is still remain stable. The provincial and central levels have more high quality staff, high technology, new equipments and high quality service than district and commune levels, it can be a good reason for this issue (USAID and Health Strategy and Policy Institue, 2009).

Figure 3.1 has shown that there are three levels in public health system: central, provincial, district and commune. And each level takes a different responsibility.

Central level: MOH is the government agency and will manage people' health in country scope. In which MOH will manage health protection and promotion, curative care, rehabilitation, traditional medicine, pharmaceutical supplies, food safety and medical equipment. MOH will manage MOH's departments include Ministry's Cabinet, departments and inspectorate. According Decision of the 1st Session of the 12th National Party Congress, MOH has 70 subordinate institutions in three major areas: hospitals, preventive medicine and professional Institutes and medical colleges and universities (USAID and Health Strategy and Policy Institue, 2009).

Provincial level: PHDs is under the management of the Provincial People's committee, there are 64 provincial health Bureaus in Vietnam. Those provincial health Bureaus will advise the Hospitals belong to Province about specialization, protection and promotion, and performs tasks and obligations as authorized by the Provincial People's committee and standing regulations. PHD is also under the

control of MOH in terms of technical direction, guidance, monitoring and inspection. PHD will manage provincial General/Specialized hospitals, centers for preventive Medicine, Provincial Secondary Medical School and Pharmaceutical Company (USAID and Health Strategy and Policy Institute, 2009).

District level: District level is under the management of District People's committee (DPC), has a task to advise District people's committee in management local people's health care, protection and promotion, and performs designated tasks and obligations as authorized by the District people's committee and the PHD. The DHO is under the management and direction of DPC in terms of direction, organizational management, payroll, and operations, and is also under the management of PHD for technical direction, guidance, monitoring and inspection. The district level has to manage district hospitals (including polyclinics) and district centers for preventive medicine (USAID and Health Strategy and Policy Institute, 2009).

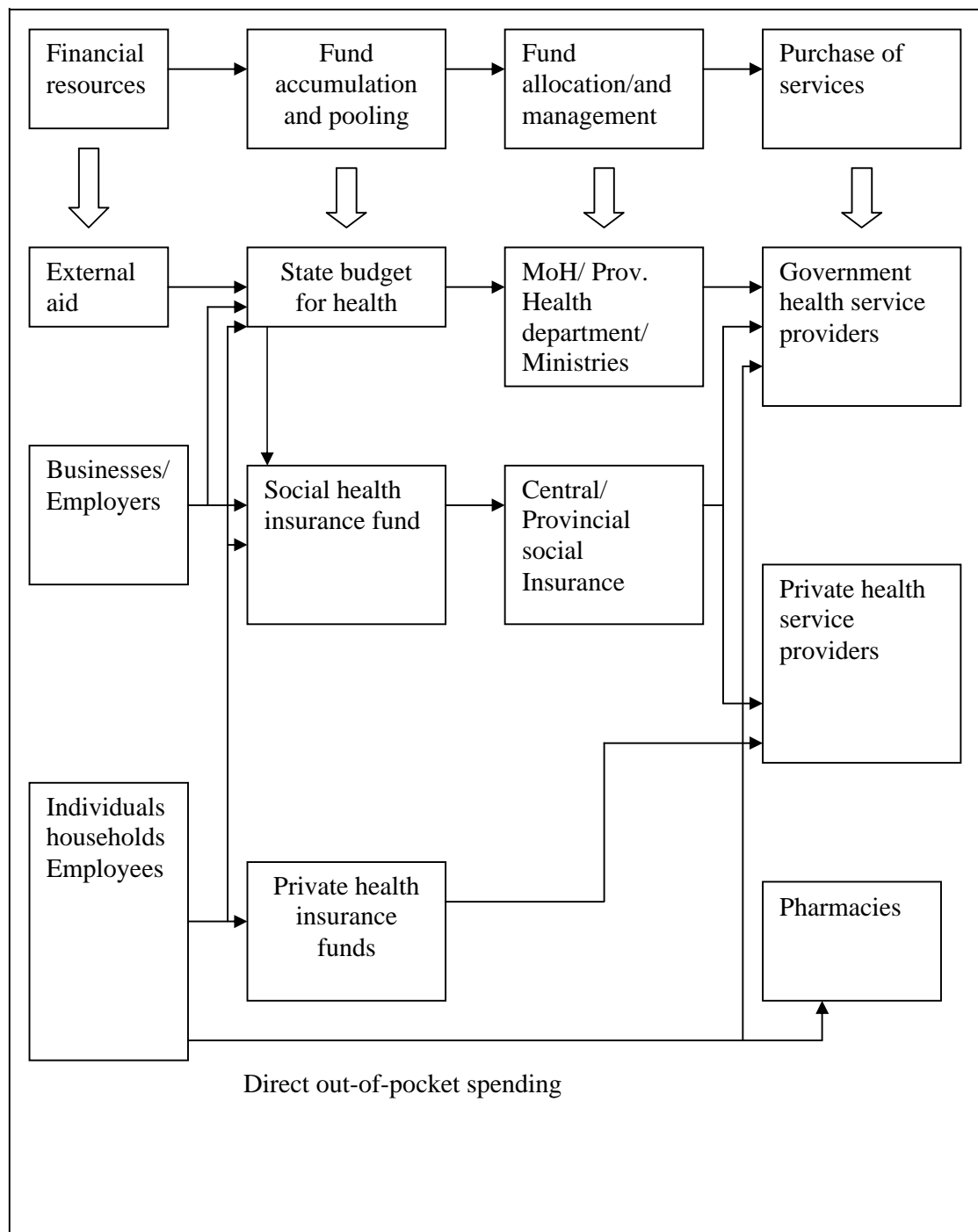
Commune level: Commune level is under the management of Commune People's committee. This is the first formal point of health care contact in the government health care system and this level will provide primary health care service for people. The task of commune level is detection of epidemics, provide care and treatment for common diseases and deliveries, and mobilize people to use birth control, practice preventive hygiene, and implement health promotion at the village level. Commune level has a mission to the DHO and the Commune People's Committee for local health's care, protection and promotion and under the management of district hospitals in term of technical guidance. And also, CHS has a responsibility to advise the voluntary health workers who operate in the communes

where people live and work. Therefore, all of village has a voluntary health worker (the voluntary health worker will trained about 3 to 9 month before doing work as voluntary health worker) (USAID and Health Strategy and Policy Institute, 2009)

3.2 An overview about health care finance of Vietnam

The figure below shows the Health financing flows in Vietnam. In which there are two major public financial flows that supply funding to health care in Vietnam are the state budget allocated directly to service providers, from MOH and Provincial health and Financial Department; and the other one is the flow from the social health insurance fund provide improved healthcare for the poor, the Government has health insurance fund as a way of purchasing health insurance for the poor and those eligible for social policy entitlements. Beside the two major public financial flows, there is one flow of household direct out – of pocket payment to health provider or to pharmacies to buy drugs. From the figure we can see that, Health financing system in Vietnam is heavily dependent on household direct payment while other flows such as ODA, private health insurance, other private expenditure just take a minor proportion of total health expenditure (Ministry of Health Vietnam, 2008).

Figure 3.2 Health finance flows in Vietnam



Source: (Ministry of Health Vietnam, 2008)

3.3 Health Policy

In Vietnam, health policy has been established many years ago. Over the course of implementation of this policy has gradually been modified to suit the actual situation and strategy of the health care “Strive so that every Vietnamese citizen can benefit from primary health services, access to and utilization of quality health services” (Ministry of Health Vietnam, 2001).

Before 1989 in Vietnam, every citizen received free health services and in 1989, the policy on partial user – fee charges in public health facilities came in to being, making an important change in health system. On 30 September 1995, Decree No. 14/TTLB was conducted to guide the partial user – fee charges in public health facilities. In this Decree, concept of partial – fee is classified very specify, in which partial user – fee will include only medicines, blood, chemical, test, X-ray, essential material, healthcare services; and will not include depreciation of capital assets, maintain cost, administrative cost, education cost, science research cost, major capital assets and facilities construction. For out-patients, partial user – fee charges will be calculated by number of visits and technical services which is used directly by out – patients. For in-patients, partial user – fee will be calculated by number of inpatients days per department, follows hospital level and direct cost which is used directly by in-patients: cost of medicine, blood, test, X-ray (Ministry of Health Vietnam, 1995).

In other hand, Decree No. 14 also shows people who have to pay and people who exempted to pay partial – fee. Whereby, people who have to pay partial – fee are those have no health insurance card; people have health insurance card but require individual examination and individual treatment; people who don't have to pay partial – fee but require individual examination and individual treatment. And people who

exempted to pay partial – fee are children under 6 years old; people with schizophrenia, epilepsy, leprosy, and tuberculosis; people live in the communes of the committee for Ethnic Minorities and Mountainous areas; People with a disability; orphans; the elderly without home; people who are very poor (Ministry of Health Vietnam, 1995);

In addition, Decree No. 14 shows how to calculate partial – fee for specific object. Thereby, partial – fee for outpatient will be calculated from number of visits, technical services, test, X-ray, minor operation, cost of drug which was used by outpatient; Technical services will include: operation, minor – operation which is used in diagnosis and treatment. Test will include: biochemistry test, hematology test, microbiology test, pathology test, and radiology test. Partial – fee for inpatient will be calculated from inpatient days; direct costs include: drug, blood, test, X-ray; Inpatient days are classified by three types. Type 1 includes those departments: department of infectious, hematology, Oncology, Cardiovascular, Neurology, Pediatrics, Gastroenterology and Urology; Type 2 includes those departments: Dermatology, Allergic, ENT, Odonto-stomatology, Surgery, Obstetric; Type 3 includes Traditional medicine and Rehabilitation. Inpatient day is estimated by minus the day check out to the day check in (if the day check out same the day check in, inpatient day can be counted by 1) (Ministry of Health Vietnam, 1995). The specific prices are shown in Appendix 1 page 137.

People who have to pay partial – fee will pay directly for hospital, those who have health insurance card will be paid by Health insurance organization, in which HI organization will pay total direct cost, inpatient days follow hospital price applied at each hospital.

The distribution and use of partial – fee are also mentioned in Decree No.14/TTLB. Thereby, total partial – fee, even hospital price paid by HI organization will distributed follow the regulation below:

- 70% of total partial – fee and source paid by HI organization will distributed to hospital to add up fund for buying drug, blood, chemical, X-ray film, material, clothes, blanket, bed (Ministry of Health Vietnam, 1995).
- 30% of them will used as follow: 25%-28% used to encourage health staffs who have high responsible, good at specialization, and good at serving patient; 2%-5% remain will sent to main organization (hospitals belong to ministry of health will send to ministry of health; hospital belong to health provincial will send to health provincial, so on) to establish the fund for helping hospitals those don't have hospital fee (Ministry of Health Vietnam, 1995).

Partial – fee and source paid by HI organization are used for direct cost (drug, chemical, X-ray...), therefore other cost such as capital cost (equipment, building, land, vehicle...), labor cost, material cost (electricity, water, telephone, office material...) will paid by hospital itself (Ministry of Health Vietnam, 1995).

On 1 July 2009, Health Insurance Law, No. 25/2008/QH12 was signed by Congress. Accordingly, Health Insurance Law issues the regulation, in which there are 54 modules which relate to Health Insurance Subject and Health Insurance Payment (The national assembly Vietnam, 2009).

Decree No. 62/2009/ND-CP was issued on 27 July 2009 to guide the regulation of Health Insurance Policy (The Government of the Socialist Republic of Vietnam, 2009). Accordingly, at Module 7, Chapter 2 of Decree No. 62 there is a clear definition about the payment level of Health Insurance organization, in which:

- a. 100 percent of healthcare cost for people belongs to item 2, 9 and 17 of Module 12 of Health insurance Law.
- b. 100 percent of healthcare at commune level;
- c. 100 percent of healthcare cost in case total cost per one health care cost is smaller than 15 percent of salary at minimum level;
- d. 95 percent of healthcare cost for people belongs to item 3, 13 and 14 of Module 12 of Health insurance Law; Remain cost will paid by patient to hospital.
- e. 80 percent of healthcare cost for other people; Remain cost will paid by patient to hospital.
- f. Incase patient require individual treatment, individual patient room, individual doctor, health insurance just pay healthcare cost follow the regulation price of government which applied for hospital and the regulation at Module 22 of Health insurance Law and Module 7 of Decree No. 62.

Below here are some decrees which relate to health care and health insurance in Vietnam. Those decrees are mentioned in the report of Economic and Social Commission for Asia and the Pacific, named Promoting sustainable Strategies to improve Access to Health Care in the Asian and Pacific Region. Whereby, the part of introduction about Vietnam was written by Nguyen Khanh Phuong – World Bank in Hanoi, 2008 (The United Nations Economic and Social commission for Asia and the Pacific, 2008).

In 1993, Decree No. 299/HDBT was issued under which the regulation on health insurance (HI) was published. Since there, HI has become a source of financial support for health care. Together with other health financing sources, private health

service provision was officially permitted and it has increasingly evolved. Health care in Vietnam has been transformed into a public – private mixed system in terms of service provision and financing (The Council of Ministers Vietnam, 1992).

On 23/2/2005, Decree No. 46/NQ/TW was promulgated by the Policy Bureau on Public Health Care, Protection and Improvement. Accordingly, development of a universal HI system takes one of the highest priorities among instructions provided by the decree. A series of financial policy revisions in health care has been introduced to achieve objectives set out in the decree, including: increase the ratio of public finance sources, decrease direct payment from the patients, upgrade medical units or health care facilities; give priority to local health networks. Ensure financial support from the Government for health service to those awarded merit in the national revolution, the poor, children under six years old and target of social priority, development and implement a road map for universal HI early in 2010; And develop a policy for hospital fee collection on the basis of accurate and sufficient calculation of direct costs for patient services, with transparent information to the public on collection of and cost items of hospital fees (The Policy Bureau Vietnam, 2005).

Directive No. 06-CT/TW of the Party Executive Committee on strengthening and development of grass – roots health network dated 22 January 2002. The directive identified the grass – roots health network (including village, commune and district health facilities) as being closest to the population hence it should ensure basic health care at a low cost for every person. In order to strengthen and develop the grass – roots health system, the Directive cites the importance of investments in its human resources, infrastructure and stable financing for recurrent activities. The directive also emphasizes the advisability of investment in the network in remote, mountainous

areas. In addition, HI development in rural areas is also mentioned: “Reviewing practical experience to set out financing support policies for developing HI in rural areas, especially HI for the poor, social policy beneficiaries and peasants” (The Party Executive Committee Vietnam, 2002).

Healthcare for the poor: Decision 139/2002/QĐ-TTg. According to the decision, a health-care fund for the poor was set – up at the provincial level that allocated VND 70,000 per capita to accommodate free health – care services for the poor and former beneficiaries on ethnic group and location priority basis (Ethnic minorities in six Northern Provinces, five highland provinces and 135 communes). Of which, VND 50,000 is provided from the Central Government budget and the remaining budget is contributed by provincial budgets. Preliminarily, the fund was used to buy an HI card for the poor or for direct payment to medical units providing free treatment services to targets of policy 139 (The Prime minister of the Socialist Republic of Vietnam, 2002).

Decision No. 289/QĐ-TTg dated 18 March 2008 on policies supporting ethnic minorities, social policy households, poor and near – poor households and fishery households. From 2008, the support for the HI premium of the poor will increase from VND 80, 000 VND per capita per year to VND 130, 000 per capita per year and 50 percent of the HI premium for member of near – poor households enrolling in the voluntary HI scheme (The Prime minister of the Socialist Republic of Vietnam, 2008).

Decree No 05/2005/NQ – CP on strengthening the socialization of education, health service, and culture and sport activities. The decree establishes the continuing direction of policies and solutions to ensure the development and promotion of

education, health service, culture and sports activities. It confirms that the Government should continue to increase investment in health service and ensure adequate budgetary support for public health, improve the speed and quality of HI, consolidate and extend the scope of compulsory HI for implementing a variety of HI types meeting public needs, strengthen HI based on contributions of insurers with support from the government and other funding sources; Encourage voluntary HI; revise hospital fee policy on the basis of accurate and sufficient calculation of direct costs of patient services, gradually move from budget allocation to cover current operational costs of health care unit to direct grants for the beneficiaries of the state medical services via the health system (The Government of the Socialist Republic of Vietnam, 2005).

Health Insurance Policy: Decree 63/2005/ND-CP. One of the important changes in decree No. 63 is regulation on supplementing beneficiaries under Decision No.139 in to the group of compulsory HI scheme enrollees that adjustment, based on preliminary assessments, indicates advantages of providing health care cards to the poor as well as supporting universal HI. Implementation of the policy brought sudden expansion of HI coverage in 2006, developing a financial protection mechanism for the poor in face of increased medical costs, improving access to medical services for the poor. Decree No. 63 also allows increased benefits for compulsory health insurers, increased payment of high technology services, payment of treatment upon request, and payment of health care services at private medical units (The Government of the Socialist Republic of Vietnam, 2005).

Financial autonomy: Decree 43/2006/ND-CP on ownership and accountability for implementing tasks, structural organization employment and finance applicable to

public administrative organizations. The decree transforms public administrative units into service providers, helping to strengthen ownership and reduce dependence on State budgets for their activities, as detailed in the Decree 10/2002/ND-CP on the financial mechanism applicable for income – generating, public – service organizations (The Government of the Socialist Republic of Vietnam, 2006).

Decision No. 153/2006/QĐ-TTg on a master plan for the development of the health system in Vietnam to 2010. Financial solutions as stipulated in the Decision follow consistently the directions and principles stipulated in Decision 35/2001/QĐ-TTg including the following important and highlighted solutions (The Prime minister of the Socialist Republic of Vietnam, 2006):

- Create a breakthrough in the rate of State investment in the health sector, to ensure funding for implementation of governmental policies for health care for accredited persons, the poor, children under six-years-old and other social policy beneficiaries.
- Revise the cost norms for regular expenditures from State budgets for the health sector with priority given to provinces in mountainous and difficult areas.
- Research and revise the policies for expenditure and payments for preventive health services concerning services authorized by the Government, supplementing part of basic expenditures and generating income for investment for such services.
- Implement the socialization of the health sector in accordance with Decree 05/2005/NQ-CP on accelerating socialization in education, health, culture and sports.

Accelerate the empowerment, ownership and accountability for implementing tasks, administration, employment and finance for public health organizations in accordance with Decree 43/2006/ND-CP.

In summary, Decree No. 14/TTLB was conducted to guide the partial user-fee charges in public health facilities; Health insurance law No. 25/2008/QH12 issues the regulation, in which has 54 modules which relate to health insurance subject and health insurance payment; Decree No. 62/2009/ND-CP was issued to guide the regulation of health insurance policy; Decree No. 299/HDBT was issued under which the regulation on health insurance was published; Decree No. 46/NQ/TW was issued by the policy Bureau on public healthcare, protection and improvement; Directive No. 06-CT/TW of the Party Executive Committee on strengthening and development of grass-roots health network; Decision No. 139/2002/QD-Ttg was issued to guide the healthcare fund for the poor at the provincial level and health insurance card; Decision No. 289/QD-Ttg was issued on policies supporting ethnic minorities, social policy households, poor and near – poor households and fishery household; Decree No 05/2005/NQ-CP was issued on strengthening the socialization of education, health service, and culture and sport activities; Decree No. 63/2005/ND-CP, the important change in this decree is regulation on supplementing beneficiaries under decision No.139 in to the group of compulsory health insurance scheme enrollees that adjustment, based on preliminary assessments, indicates advantages of providing health care cards to the poor as well as supporting universal health insurance; Decree 43/2006/ND-CP on ownership and accountability for implementing tasks, structural organization employment and finance applicable to public administrative

organizations; Decision No. 153/2006/QĐ-TTg on a master plan for the development of the health system in Vietnam to 2010.

3.4 Payment mechanism

For many years, the hospital's income comes from three main sources: government budgets, out-of-pocket payments by patient and health insurance agency (VSS). In which government budgets have decreased when compare with other while health insurance out – of – pocket payments by patients has increased (Ministry of Health, 2000-2006). From there both out-of-pocket payments by patient and health insurance pay hospital on a fee for services (FFS) basis. In 1995, a fee schedule was published. In which the fees in the schedule will include a mixture of per-item charges such as tests...and per diem rate such as inpatient stays...and drugs are not included in the list of fees (Tien et al, 2011).

Out-of-pocket expenditure on health in Vietnam accounted for a large part of total health expenditure. The research by MOH shows that the household share declined from 63 percent in 2000 to 55 percent in 2003 (Ministry of Health, 2000-2006) but it rebounded in 2004, from 63.9 percent in that year to 65.8 in 2005 and 62.8 percent in 2006. The report of Economic and Social Commission for Asia and the Pacific in 2008 shows the distribution of out-of pocket expenditure on health, in which 30 percent is used in paying user fees at health facilities (both public and private) and the remaining 70 percent is spent on drugs and medical material (The United Nations Economic and Social commission for Asia and the Pacific, 2008).

The government budget for health is allocated at center and local levels. The report of national health account show that, government budgets were distributed to central, province, district and commune levels follow the proportions of 36.8; 44.7;

16.2 and 2.3 percent, while the proportion of reimbursement from HI funds for health care at those level was 18.9; 74.4 and 6.7 percent. This report also shows that most of the government budget is used for curative care, in which 84.8 percent for curative care and only 13.8 percent went for preventive care (The United Nations Economic and Social commission for Asia and the Pacific, 2008).

By years, Health financing system was transformed in to a mixed, multi – source system, the way of allocating government budgets for public hospitals was changed but the reimbursement method by HI schemes and method paid user fees still remain the same (The United Nations Economic and Social commission for Asia and the Pacific, 2008).

The government will allocate budget for healthcare through curative and preventive in three ways:

Firstly, government distributes directly budget for public health facilities, therefore they can provide preventive and curative serves. At the central level, Government will allocate budget to provinces base on population size and a regional adjustment coefficient. At provincial and local level, Government will distribute budget base on the number of beds or number of staff members which was reported by hospitals (Tien et al, 2011).

Secondly, government allocates budget for purchasing HI for some target groups (including more than 14 million poor people) and after that HI fund reimburses for health services to health facilities (both public and private). By Decree No.63/2005/ND-CP and new Health Insurance Law, there are more than 14 million poor people have subsidized through HI. As report of national health account shows Government reimbursement for health services to the poor based on user fees has thus

taken three stages: from direct budgeting (before 2003) to reimbursement based on user fees directly to hospitals (2003 to 2005) to reimbursement through HI funds (since 2006) (Tien et al, 2011).

Lastly, Government pays for health services for children under six years old through user fees. In which, health facilities will reimbursed by listing the services provided and submitting them to the relevant provincial health (Tien, T.V et al, 2011)Health insurance has become an important source of finance for the health financing system of Vietnam. Health insurance will cover civil servants, pensioners, salaried workers in State – owned and private enterprises, Vietnamese workers in foreign – owned firms, international organizations and some special groups under social protection (Government, 2009). When Decree No. 63/2005 published, the poor have been included in the health insurance scheme. In other hand, voluntary health insurance will focus on the compulsory members, farmers and workers in the informal economy and school children over the age of six years. In the general government budget for health care, HI fund grew from 21 percent in 2002 to 61 percent in 2006 and when compare with total health expenditure, the contribution of HI also increase from 4.4 percent in 2002 to 11 in 2006 (Tien et al, 2011).

3.5 Thai Nguyen Province

Thai Nguyen is one of provinces located in the mountainous area of the Northern of Vietnam. The province has an area of 3,562.82 km². The total population is 1,2 million inhabitants with eight ethnics: Kinh, Tay, Nung, San Diu, H'mong, San Chay, Hoa and Dao. Thai Nguyen is also known as the third education center of Vietnam which is under Hanoi and Hochiminh City. In Thai Nguyen, there are 21 universities including 1 Medical University, 11 colleges and 9 training centers. Thai

Nguyen province is considered as regional healthcare center of north-east are. There are 1 Central hospital, 3 provincial hospitals and 7 districts hospital located in Thai Nguyen. In addition, there are health centers that include centers for preventive medicine and 1 specialized hospital, TB hospital. At grassroots level there are commune health station and health workers to take care for population at commune and carrying out national health care programs (Thai Nguyen Portal, 2010).

Figure 3.3 Thai Nguyen province in Vietnam map



Source: Thai Nguyen Portal, 2010

Economic and development of Thai Nguyen Province

The rate of economic growth of Thai Nguyen province in 2009 was 9.1%; the average gross domestic product per person was estimated over VND 14,6 million about 0.8% in total GDP of Vietnam in 2009 (Thai Nguyen Portal, 2010).

Main occupation of Thai Nguyen province is agriculture and aquaculture. Thai Nguyen City is an important economic center as it is the center of heavy industries in

which Thai Nguyen Steel and Iron Company is one of the twenty biggest companies in Vietnam (Thai Nguyen Portal, 2010).

As mentioned above, needs for manager to know the unit cost of providing health care service in the hospital and to understand the model for calculate cost of treatment of certain disease has been increasing. As the hospital located in the City, easy and convenience to access and Direct Board and other managers recognized benefit of having study result so that they were willing to collaborate in carrying out research.

3.6 Thai Nguyen General Hospital

Thai Nguyen General Hospital is the hospital at first level of care located in Thai Nguyen City. The hospital was established in 1951 and has 879 beds. The hospital is managed by MoH, both technical and financial parts. It provides services for more than 1,2 million citizens in the province (Thai Nguyen General Hospital) and other patients in the province nearby. In addition, Thai Nguyen General Hospital has responsibility to provide technical supports for distric hospitals and distric health center and other health facilities surround. The following is administrative organization structure of Thai Nguyen General Hospital:

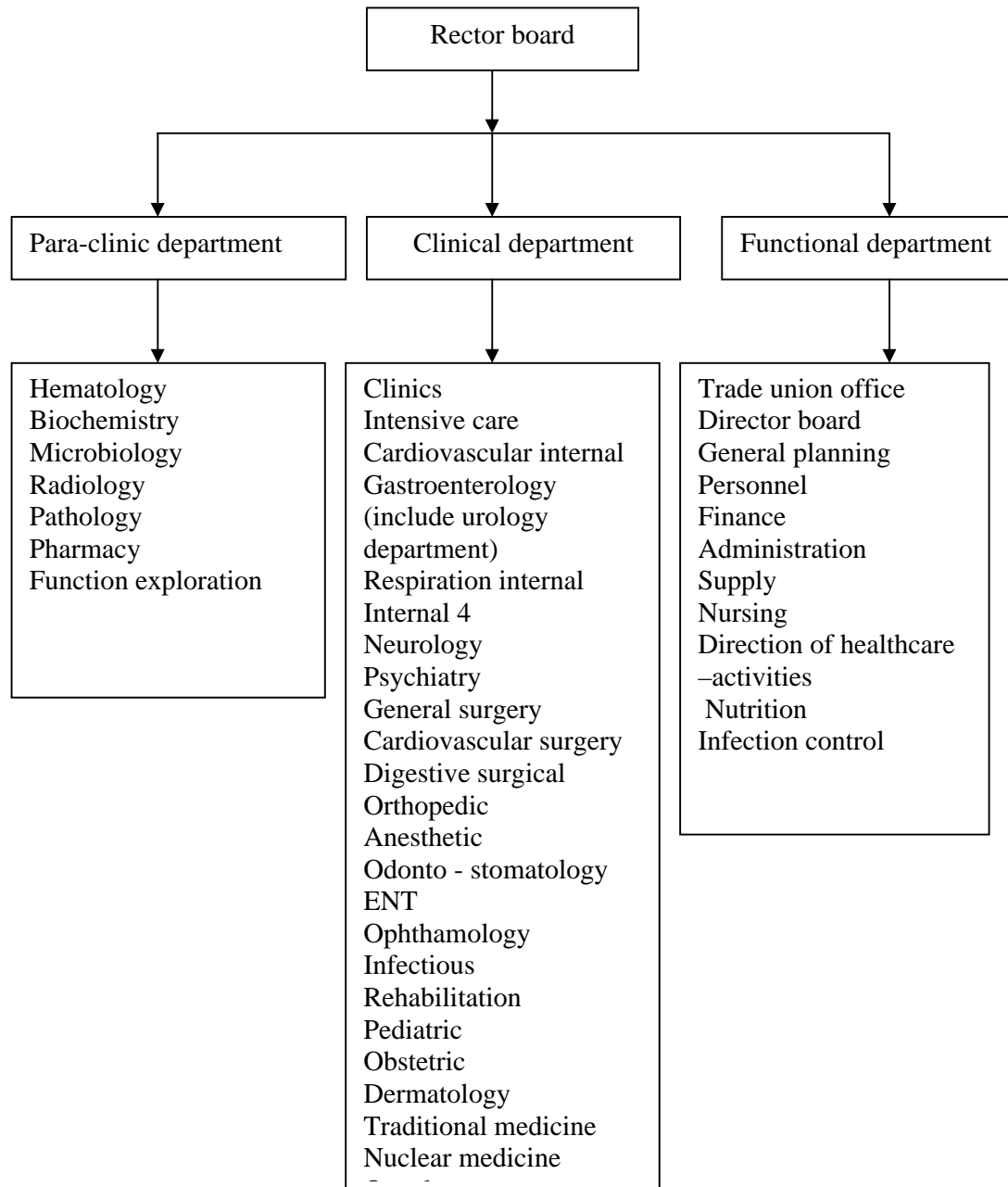
Administrative organization of Thai Nguyen General Hospital: The director is the top administrator with 3 Vice Directors for medical care, for research and international affair and financial support. Organization structure of the hospital, there are three main bodies as in the figure 3.4

Hospital has 42 departments with 845 staff. According to the function of those departments, it was divided into three groups: functional departments, Para-clinic departments and clinical departments. Functional departments provide support for all

departments in hospital and it is called non-revenue producing cost centers; Seven Para-clinic departments are considered as revenue producing cost centers as those departments provide care for both inpatient care and other health care service. When patient discharge from the hospital, they have to pay for tests or procedures used at price that was set up by hospital. It means that patients did not receive support from these departments so we assume that those departments would be treated as production cost centers. 22 clinical departments provide either outpatient or inpatient care and each of them would be one cost center.

In Thai Nguyen General Hospital, urology department belongs to gastroenterology department. The urology department has no out – patient services and this urology just has in – patient services. In Vietnam health system, at the beginning, patient will come to examine at clinic. After checking health status, if the health status of patient is very serious and has to stay at hospital, patient will be sent to department which patient’s disease relate to; if the health status of patient is not so serious, and can be treated at home, patient can receive some medicine and come back home. Urology department has no out-patient service because, patients have already come to clinic first and after that they were sent to this department for inpatient treatment.

Figure 3.4 Structure of Thai Nguyen General Hospitals



Source: (Thai Nguyen General Hospital)

There are 9821 outpatient and 3853 inpatient in 2011 in Thai Nguyen. The table 3.1 has shown that the bed occupancy rate of this hospital is quite high with 121.2% per year (Thai Nguyen General Hospital). There were a big number of outpatient and inpatient days however the length of stay seems quite high. It may lead to the question of efficiency of resource used of the hospital. Study result of this study will provide direct board the reason inside this number.

Table 3.1 Basic characteristic and activity statistics of Thai Nguyen General Hospital, 2011

Characteristics/statistics	
Level	I
Number of departments	42
Number of staff	845
Number of plan beds	800
Actual bed in use	879
Bed-occupancy rate	121.2
Number of outpatient	9821
Number of inpatient	38531
Number of outpatient visit	1986695
Number of inpatient day	327556
Average inpatient day	8.5

Source: Thai Nguyen General Hospital 2011

CHAPTER IV

RESEARCH METHOD

Research method is the important part of doing research. For this study, research method included four main components; they were research design, conceptual framework, data analysis and source of research and steps in hospital cost analysis

4.1 Research design

This study is the descriptive study

4.2 Conceptual framework

This conceptual framework provided an overview about research plan, the information need to collect and calculated. For this research, conceptual framework provided four main steps to do cost analysis.

Step one, Organization of Thai Nguyen General Hospital was analyzed and divided into three center groups: non revenue producing cost center (NRPCC), revenue producing cost center (RPCC) and patient service (PS).

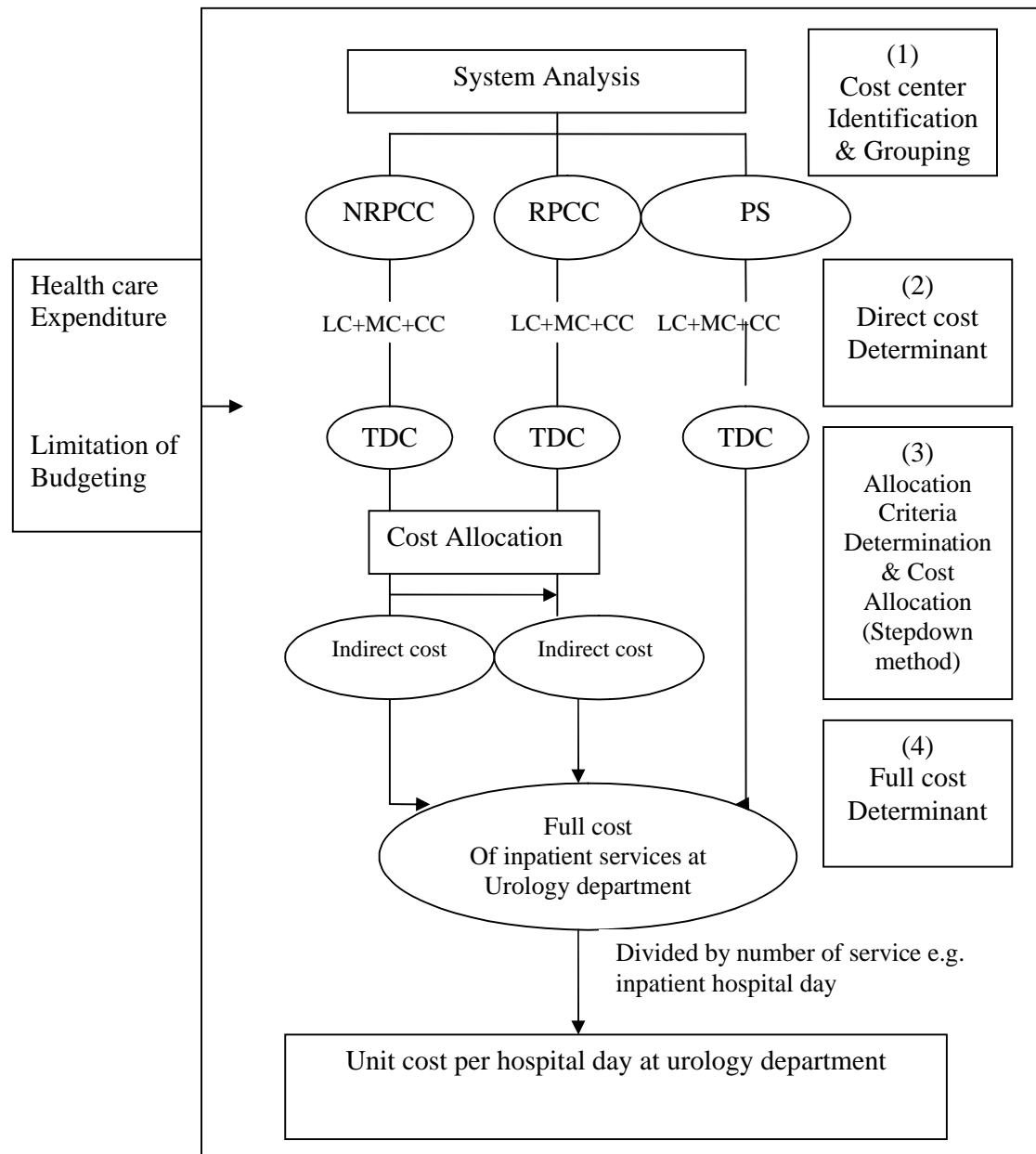
Step two, direct cost of each cost centers in three center groups was calculated include labor cost (LC), material cost (MC), capital cost (CC).

Step three, direct cost of NRPCC and RPCC was allocated to PS by cost allocation method, in this study step – down method was used to allocated cost from NRPCC and RPCC to PS. When compare with other cost allocation method, step – down method take more advantage than others because the calculation of this method is not so complicate. Although the reliability of this method is not as good as simultaneous equation, the reliability of this method is higher than direct distribution

method and can be accepted in reality. Step down method is most commonly used in the studies reviewed in literature review.

Step four, full cost of patient service will be calculated include indirect cost of NRPCC, indirect cost of RPCC and direct cost of PS. In this research, patient service just focuses on urology department. After having a full cost of PS, unit cost will be calculated by dividing the full cost of PS to number of service. In this study number of service will be number of inpatient days (The specific classification of cost center is mentioned in table 4.2).

Figure 4.1 Conceptual framework



4.3 Data source and analysis

4.3.1 Data source

Labor cost data were collected from the financial report and salary report of Thai Nguyen General Hospital. This data included wages; allowances; allowance positions; working night, over time; allowance toxic, dangerous, Special allowance; Seniority allowance beyond the frame and time worked (time & motion study) (Shepard, Hodgkin, and Anthony, 2000).

Material costs: Data were collected from dispensed record at the financial department. The material cost collected by using material cost collecting form and was classified one by one such as: Public service, electricity & water, fuel & environment cleaning, Office cost, repair annual assets, Specialized function cost, other specialized function (Shepard, D., Hodgkin, D., and Anthony, Y.E, 2000). The administrator of each cost center will give the data about material cost per month of each department to administration department, therefore in this study material costs will be taken from administration department and won't have to calculate.

Drug and Medical supplies: Data were collected from dispensed record at the pharmacy department and supply department (Shepard, Hodgkin, and Anthony, 2000)

Capital cost: Data were collected from dispensed record at each department. This data included: Equipment, furniture, building, vehicle, useful life time, original price, number of equipment, number of furniture, number of vehicle, the beginning year (or the purchased year) (Shepard, Hodgkin, and Anthony, 2000).

4.3.2 Data analysis

In calculating, depreciations and the useful life of building and equipment will follow the guideline of Ministry of Finance of Vietnam, 2008. Local currency values were converted in to US dollars using the 2011 exchange rate of US\$ 1 = 21036 VND

Calculation capital cost which included two components capital cost of assets, vehicle, furniture and opportunity cost of land stocked inventory (Riewpaiboon, 2008).

In reality, capital asset will be worn down by the activities of department which is using this capital asset and this depreciation is an expense. Therefore, to get the actual cost of capital asset, depreciation needs to be calculated. The straight –line depreciation is known as the simplest approach to depreciation (Walker, and Kumaranayake, 2002). This method assumes that the services from the capital item are divided equally over the useful life of the capital. Therefore, the annual cost of capital is now the current or replacement cost of the capital item divided by its expected useful life (Walker, and Kumaranayake, 2002).

Capital cost of asset can be calculated by the formula below:

$$\text{Capital cost in year } k = \frac{\text{Replacement cost in year } k}{\text{Annualization factor}}$$

Source: (Shepard, D., Hodgkin, D., and Anthony, Y.E, 2000)

Where

Capital cost in year k is equivalent annual cost which is the cost per year of owning and operating an asset over its entire lifespan in year k.

Annualization factor is the annuity factor which is used to calculate the present value of future one dollar cash flows. This annuity factor can be calculated by formula

$$A = \frac{1-(1+r)^{-t}}{r}$$

Source: (Shepard, Hodgkin, and Anthony, 2000)

Where r: real interest rate

t: Useful life (years)

In the depreciation calculation, replacement cost is used instead original cost. Because depreciation cost calculation is a process for resources use planning, if there is inflation, original cost will understate the amount required to replace a given asset. Replacement cost is the more relevant measure for that planning resource use (Shepard, Hodgkin, and Anthony, 2000). The replacement cost can be calculated by this formula:

$$\text{Replacement cost in the year of analysis} = \text{IAF} \times \text{original price}$$

Source: (Riewpaiboon, 2008)

Where

IAF is inflation adjustment factor reflects the proportionate change in prices between two years. Changes in the price of particular set of goods and services are used to calculate the overall inflation rate in a country. These measures are usually referred to as consumer price index (CPI) (Kumaranayake, 2000). Inflation adjustment factor can be calculated by this formula:

$$\text{IAF} = \frac{\text{Consumer price index in year of analysis}}{\text{Consumer price index in year of purchasing}}$$

Source: (Kumaranayake, 2000)

CPI is consumer price index measures changes in the price level of consumer goods and services purchased by households. In Vietnam, CPI is estimated by Vietnam general statistics office. The detail CPI table can see in appendix 2 page 140.

Below here is the table useful life for almost assets which is issued by Ministry of Finance Vietnam on 29/05/2008.

Table 4.1 Useful life of assets

<i>Capital assets</i>	<i>Useful life (year)</i>
<i>I- Building</i>	
<i>1. Building level I, special level</i>	<i>80</i>
<i>2. Building level II</i>	<i>50</i>
<i>3. Building level III</i>	<i>25</i>
<i>4. Building level IV</i>	<i>15</i>
<i>7. Other</i>	<i>10</i>
<i>II- Equipment</i>	
<i>A- Office equipment</i>	
<i>- Computer</i>	<i>5</i>
<i>- Media equipment</i>	<i>5</i>
<i>- Data recorder</i>	<i>5</i>
<i>- Other informatics equipment</i>	<i>5</i>
<i>- Printer</i>	<i>5</i>
<i>- Projector</i>	<i>5</i>
<i>- Fax</i>	<i>5</i>
<i>- Shredder</i>	<i>5</i>
<i>- Water heater</i>	<i>5</i>
<i>- Aspirator</i>	<i>5</i>
<i>- Television</i>	<i>5</i>
<i>- Video</i>	<i>5</i>
<i>- CD</i>	<i>5</i>
<i>- DVD</i>	<i>5</i>
<i>- Audio device</i>	<i>5</i>
<i>- Recorder</i>	<i>5</i>
<i>- Camera</i>	<i>5</i>
<i>- Refrigerator</i>	<i>5</i>
<i>- Washing machines</i>	<i>5</i>
<i>- Photocopy</i>	<i>8</i>
<i>- Safe</i>	<i>8</i>
<i>- Generator</i>	<i>8</i>
<i>- Air conditioning</i>	<i>8</i>
<i>- Lift</i>	<i>8</i>

<i>Capital assets</i>	<i>Useful life (year)</i>
- Other	8
<i>B- Specialization equipment</i>	
- Equipment use in textile sector	10
- Equipment use in food industry	8
- Equipment use in health sector, film	8
- Informatics equipment	8
- Pharmaceutical equipment	8
- Other equipments	10
- Measuring equipments	10
- Optical devices	10
- Electric equipment	8
- Radiation – measuring devices	10
- Special equipments	8
- Other measuring devices	10
<i>III- Vehicle, media equipment</i>	
<i>A- Vehicle</i>	
1. Transport of railway	10
2. Transport of streamline	10
3. Road transport	10
4. Transport of airline	10
7. Other transport	10
<i>B- Media equipment</i>	
1. Media equipment	5
2. Telephone cable system	5
4. Cell phone	5
5. Lane lines	5
6. Electric cable system	5
7. Other	5
<i>IV- Management equipment</i>	
- Working table	8
- Working chair	8
- Table set	8
- Data cabinets	8
- Other	8

Source: Ministry of Finance Vietnam, 2008

Opportunity cost of land used will not included in this research, because the price of land in Vietnam fluctuates sharply, there is no data about price of land.

Calculation of recurrent cost

Cost of personnel or labor cost (LC) was calculated by

$LC = [(Total\ salary\ in\ one\ year + Total\ bonus + Total\ health\ insurance\ paid\ by\ hospital) \times \% \text{ working time}] + Allowance\ (position, \text{ dangerous allowance})$

Total salary in one year = salary of staff per month x number of months hospital paid salary for staff

Salary of staff per month = basis salary x salary index (relate to education level)

Health insurance paid by hospital = 8% of salary of staff per month

Total health insurance in one year = health insurance paid by hospital x number of month hospital paid health insurance for staff

For example, in 2009, hospital hired a staff at master degree work 100% of time for hospital in 6 months. The salary per month which hospital paid for this staff is \$300 in 6 months. Hospital had to pay health insurance for this staff equal 8% of salary per month. Because good completion of work, this staff received \$50 bonus each month, and got \$50 allowance (assumption data).

Total salary in 2009 of staff = \$300 x 6 months= \$1800

Total health insurance in 2009 of staff = \$300 x 8% x 6 month = \$144

Total bonus in 2009 of staff = \$50 x 6=\$300

Total allowance in 2009 of staff = \$50 x 6 = \$300

Labor cost of staff in 2009 = [(\$1800 +300+ \$144) x 100%] + \$300 = \$2544

Material cost

In this research, material cost includes cost of electricity, cost of water, cost of telephone, cost of chemical, cost of internet, cost of maintenance, cost of office material, cost of cleaning, cost of special material and other cost. As mentioned before, those cost was collected directly at administration department and don't have to calculate.

Total direct cost

Total direct cost of cost centers in Thai Nguyen General Hospital will include capital cost and recurrent cost which includes labor cost and material cost

Total cost (TC) = Capital cost + Recurrent cost (labor cost& material cost)

4.4 Steps in hospital cost analysis

The methodology of this study is based on cost analysis using step down method. There are four main steps to involve in the standard costing methodology

Step 1 (Cost center Identification)

Analyze organization structure and function of all departments of Thai Nguyen General Hospital and then divided in to three groups

Table 4.2 Cost centers classification

NRPCC	RPCC	PS
Trade union office	Hematology	Clinics
Rector board	Biochemistry	Intensive care
General planning	Microbiology	Cardiovascular internal
Personnel	Radiology	Gastroenterology (include
Finance	Pathology	urology department)
Administration	Pharmacy	Respiration internal
Supply	Function	Internal 4
Nursing	exploration	Neurology
Direction of healthcare – activities		Psychiatry
Nutrition		General surgery

Infection control	Cardiovascular surgery Digestive surgical Orthopedic Anesthetic Odonto - stomatology ENT Ophthalmology Infectious Rehabilitation Pediatric Obstetric Dermatology Traditional medicine Nuclear medicine Oncology
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Step 2 (Compiling the Total Direct Operating cost)

TDC = Material cost + Labor cost + Capital cost

- Labor cost: include wages; allowances; allowance positions; working night, over time; allowance toxic, dangerous, Special allowance; Seniority allowance beyond the frame and time worked (time & motion study) of all staffs in each department of Thai Nguyen General Hospital
- Material cost: include medicines; chemical; office materials; public service; electricity & water; fuel & environment cleaning; Office cost; repair annual assets; Specialized function cost, other specialized function
- Capital cost: include major equipments, vehicles, furniture, machineries, and building.

Step 3 (Defining allocation criteria)

Allocation criteria was created base on function of Non revenue producing cost center and revenue producing cost center.

Trade union office have function to support and encourage staffs in all departments who have a good work and nominate staff go in to trade union, trade union office base on staffs of other departments to allocate cost.

Rector board manage and direct all staffs in hospital, administration manage staffs, documents of all centers in hospital and nutrition provide food for all staffs in hospital, therefore, rector board, administration and nutrition base on number staffs of other departments to allocate cost.

Personnel manage total number of hospital staffs, this cost center also bases on number staffs of other department to allocate cost.

Financial manage salary, bonus, allowance of staffs, this cost center bases on number staffs of other department to allocate cost. Supply based on capital cost to allocate cost

For Direction of healthcare activities, nursing and infectious control those cost centers's service relates directly to patient, therefore, those cost centers base on number patients of patient service centers to allocate cost.

For pharmacy, because this department support patient by prescription, and for inpatient each day they will received one prescription. Therefore total number of inpatient days was use to allocate cost.

Supply manages all of equipments, vehicles, and furniture in all centers of hospital, therefore supply center based on capital cost to allocate cost.

Table 4.3 Allocation criteria

<i>Cost center</i>	<i>Code</i>	<i>Allocation criteria</i>
<i>Trade union office</i>	<i>NRPCC</i>	<i>Number of staff</i>
<i>Rector board</i>	<i>NRPCC</i>	<i>Number of staff</i>
<i>General planning</i>	<i>NRPCC</i>	<i>Number of staff</i>

<i>Personnel</i>	<i>NRPCC</i>	<i>Number of staff</i>
<i>Finance</i>	<i>NRPCC</i>	<i>Number of staff</i>
<i>Administration</i>	<i>NRPCC</i>	<i>Number of staff</i>
<i>Supply</i>	<i>NRPCC</i>	<i>Capital cost/number of patient</i>
<i>Direction of healthcare - activities</i>	<i>NRPCC</i>	<i>Number of patient</i>
<i>Nutrition</i>	<i>NRPCC</i>	<i>Number of staff</i>
<i>Nursing</i>	<i>NRPCC</i>	<i>Number of patient</i>
<i>Infectious control</i>	<i>NRPCC</i>	<i>Number of patient</i>
<i>Pharmacy</i>	<i>RPCC</i>	<i>Total number of inpatient days</i>

Source: Author

Step 4 Indirect cost allocation

In this research, step – down cost allocation method was used to allocate direct cost of NPCC and RPCC to PS.

Firstly, direct cost of NRPCC was allocated to NRPCC and PS base on allocation criteria on table 4.3.

Secondly, cost of RPCC (equal direct cost of RPCC plus indirect cost come from direct cost of NRPCC) was allocated to PS.

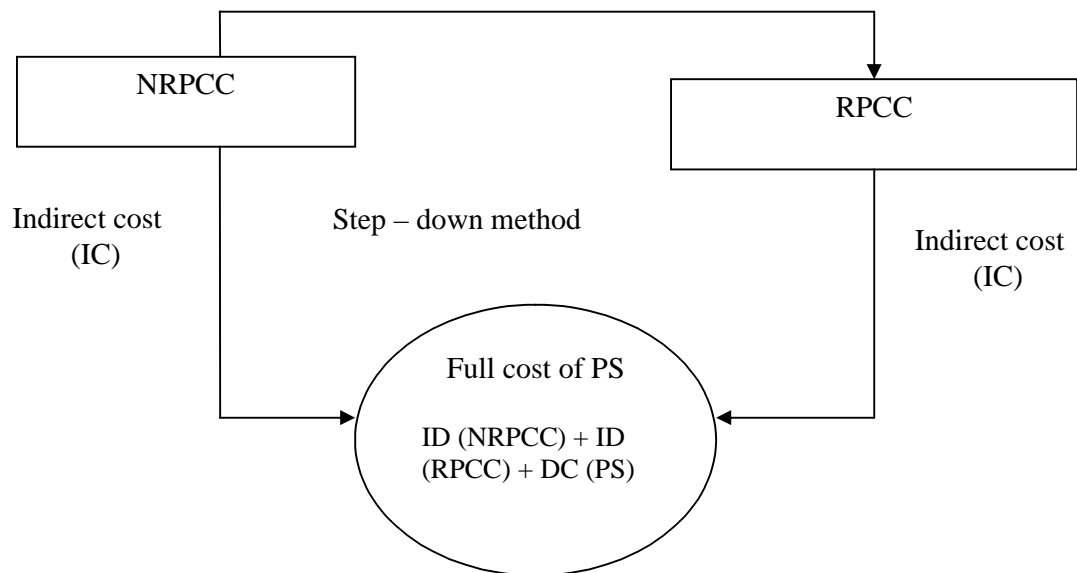
After allocation, PS had indirect cost came from NRPCC and RPCC.

As mentioned in chapter III, page 73 cost of cost centers: hematology, biochemistry, microbiology, pathology, radiology and function exploration weren't be allocated to PS.

Step 5 (Full cost and unit cost estimation)

Full cost of PS will include direct cost of PS, indirect cost came from direct cost of NRPCC and indirect cost came from cost of RPCC which included direct cost of RPCC and indirect cost came from NRPCC.

Figure 4.2 Full cost of patient service centers



Source: Kamolratanakul, 2000

Where

DC: Direct cost

ID: Indirect cost

After having a full cost of PS (in this study we focus on Urology), we determine the unit cost of PS

$$\text{Unit cost of IPD} = \frac{\text{Full cost of Urology Department}}{\text{Number of IPD}}$$

List of the assumptions applied

This study was carried out base on assumptions below:

- Opportunity cost of land will not included in this study

- Assume curtain life of equipment will be five years for office equipment, medical equipment (For some assets have useful life are eight years, this research still assume that the useful life of them was five years because those assets have broken but still used in reality and also some of assets have the low original price because those assets was support from equipment companies)
- Cost of Para-clinic centers will not allocated to patient services
- In this research, the interest rate will be 0.03 which is suggested in book named “Analysis of Hospital costs: A manual for managers” (Shepard, Hodgkin, and Anthony, 2000).
- In this research, the total cost of urology department was equal 31% of Gastroenterology department which was based on number of inpatientdays.

CHAPTER V RESULTS

5.1 Total direct cost of cost centers in Thai Nguyen General Hospital

Labor cost

Labor cost will include salary, bonus, allowance and percentage of working time of staff and allowance of all staffs in all cost centers. In Thai Nguyen General Hospital, some staffs working in two departments, the working time of those staff will be estimated as 30% of working time use for specialization activities, 70% of working time use for management activities. Other staffs who work in one department, percentage of working time equal 100%. This data was collected in 2011.

Table 5.1 Labor cost of NRPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Total salary and bonus (1)</i>	<i>Total health insurance (2)</i>	<i>(total salary and bonus + total health insurance) x % working time (3)</i>	<i>Additional allowance (4)</i>	<i>Total Labor cost (5)=(3)+(4)</i>
<i>Trade union office</i>	<i>NRPCC1</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>
<i>Rector board</i>	<i>NRPCC2</i>	<i>14,822</i>	<i>2,895</i>	<i>13,752</i>	<i>2,220</i>	<i>15,973</i>
<i>General planning</i>	<i>NRPCC3</i>	<i>24,565</i>	<i>5,316</i>	<i>28,925</i>	<i>2,762</i>	<i>31,687</i>
<i>Personnel</i>	<i>NRPCC4</i>	<i>32,645</i>	<i>5,363</i>	<i>43,970</i>	<i>3,341</i>	<i>47,311</i>
<i>Finance</i>	<i>NRPCC5</i>	<i>26,175</i>	<i>5,548</i>	<i>31,723</i>	<i>3,774</i>	<i>35,497</i>
<i>Administration</i>	<i>NRPCC6</i>	<i>49,094</i>	<i>8,455</i>	<i>62,779</i>	<i>5,445</i>	<i>68,224</i>
<i>Supply</i>	<i>NRPCC7</i>	<i>26,147</i>	<i>3,380</i>	<i>29,527</i>	<i>1,354</i>	<i>30,881</i>
<i>Nursing</i>	<i>NRPCC8</i>	<i>11,540</i>	<i>2,188</i>	<i>13,728</i>	<i>1,130</i>	<i>14,858</i>
<i>Direction of healthcare activities</i>	<i>NRPCC9</i>	<i>5,539</i>	<i>1,112</i>	<i>5,068</i>	<i>421</i>	<i>5,489</i>
<i>Nutrition</i>	<i>NRPCC10</i>	<i>6,681</i>	<i>1,114</i>	<i>7,794</i>	<i>485</i>	<i>8,280</i>
<i>Infectious control</i>	<i>NRPCC11</i>	<i>35,087</i>	<i>8,040</i>	<i>43,128</i>	<i>2,282</i>	<i>45,410</i>
<i>Total</i>		<i>232,294</i>	<i>43,411</i>	<i>280,395</i>	<i>23,216</i>	<i>303,610</i>

The result in table 5.1 shows that the total labor cost of NRPC was USD 303,610. And look at this table can also see that, trade union has labor cost equal zero because this department has no staff, those people who take responsibility for doing function in this department comes from other department. Table 5.1 also shows that total labor cost of administration was the highest (USD 68,224) when compare with other NRPC, and direct of healthcare activities got the smallest labor cost (USD 5,489).

Table 5.2 Labor cost of RPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Total salary and bonus (1)</i>	<i>Total health insurance (2)</i>	<i>(total salary and bonus+ total health insurance) x % working time (3)</i>	<i>Additional allowance (4)</i>	<i>Total Labor cost (5)=(3)+(4)</i>
<i>Hematology</i>	<i>RPCC1</i>	<i>35,581</i>	<i>7,451</i>	<i>43,109</i>	<i>4,332</i>	<i>47,441</i>
<i>Biochemistry</i>	<i>RPCC2</i>	<i>18,148</i>	<i>3,741</i>	<i>21,889</i>	<i>1,527</i>	<i>23,416</i>
<i>Microbiology</i>	<i>RPCC3</i>	<i>10,772</i>	<i>2,458</i>	<i>13,230</i>	<i>1,026</i>	<i>14,256</i>
<i>Radiology</i>	<i>RPCC4</i>	<i>36,733</i>	<i>5,959</i>	<i>43,488</i>	<i>2,501</i>	<i>45,990</i>
<i>Pathology</i>	<i>RPCC5</i>	<i>14,058</i>	<i>2,566</i>	<i>16,624</i>	<i>998</i>	<i>17,622</i>
<i>Pharmacy Function exploration</i>	<i>RPCC6</i>	<i>31,884</i>	<i>6,596</i>	<i>38,480</i>	<i>2,548</i>	<i>41,029</i>
<i>Function exploration</i>	<i>RPCC7</i>	<i>29,002</i>	<i>6,613</i>	<i>35,615</i>	<i>2,403</i>	<i>38,018</i>
<i>Total</i>		<i>176,179</i>	<i>35,384</i>	<i>212,436</i>	<i>15,335</i>	<i>227,771</i>

Table 5.2 shows that the total labor cost of RPCC was USD 227,771. In which, labor cost of hematology was the highest (USD 47,441) while microbiology had the smallest labor cost (USD 14,256) when compare with other RPCC.

Table 5.3 Labor cost of PS of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Total salary and bonus (1)</i>	<i>Total health insurance (2)</i>	<i>(total salary and bonus + total health insurance) x % working time (3)</i>	<i>Additional allowance (4)</i>	<i>Total Labor cost (5)=(3)+(4)</i>
<i>Clinics</i>	<i>PS1</i>	79,068	16,160	95,228	8,714	103,942
<i>Intensive care</i>	<i>PS2</i>	55,790	12,481	68,271	4,578	72,850
<i>Cardiovascular internal</i>	<i>PS3</i>	33,347	7,649	40,997	3,410	44,406
<i>Internal 4</i>	<i>PS4</i>	21,729	4,623	26,352	2,629	28,981
<i>Neurology</i>	<i>PS5</i>	29,019	6,027	35,640	2,525	38,164
<i>Psychiatry</i>	<i>PS6</i>	22,402	5,000	27,402	2,896	30,298
<i>Orthopedic</i>	<i>PS7</i>	50,400	10,881	62,102	4,529	66,631
<i>Anesthetic</i>	<i>PS8</i>	39,738	8,403	48,296	5,081	53,378
<i>General surgery</i>	<i>PS9</i>	37,795	8,244	47,274	5,176	52,449
<i>Ophthalmology</i>	<i>PS10</i>	28,513	6,073	34,585	3,498	38,084
<i>ENT</i>	<i>PS11</i>	20,992	4,247	25,240	2,224	27,463
<i>Odonto - stomatology</i>	<i>PS12</i>	30,032	6,345	36,633	3,805	40,438
<i>Pediatric</i>	<i>PS13</i>	54,223	11,538	108,956	4,464	113,420
<i>Obstetric</i>	<i>PS14</i>	56,940	12,269	69,209	4,883	74,092
<i>Infectious</i>	<i>PS15</i>	23,127	4,832	27,959	2,841	30,800
<i>Rehabilitation</i>	<i>PS16</i>	28,711	6,006	35,674	4,328	40,002
<i>Traditional medicine</i>	<i>PS17</i>	16,233	3,403	20,397	1,596	21,993
<i>Oncology</i>	<i>PS18</i>	38,218	9,645	47,863	4,603	52,465
<i>Nuclear medicine</i>	<i>PS19</i>	21,469	2,996	24,464	674	25,138
<i>Respiration internal Gastroenterology (include urology department)</i>	<i>PS20</i>	31,516	6,752	38,268	2,672	40,940
<i>Dermatology</i>	<i>PS21</i>	32,817	6,544	39,361	2,835	42,196
<i>Digestive surgical</i>	<i>PS22</i>	17,230	3,647	20,877	2,795	23,672
<i>Cardiovascular surgery</i>	<i>PS23</i>	22,328	4,801	27,129	29,097	56,226
<i>Cardiovascular surgery</i>	<i>PS24</i>	12,001	2,498	14,499	2,074	16,573
<i>Total</i>		803,637	171,064	1,022,676	111,926	1,134,602

Thai Nguyen General Hospital has 24 patient service centers (PS). The total labor cost of PS was USD 1,134,602. Table 5.3 shows that clinics and pediatric were

two cost centers have the highest labor cost which were USD 103,942 for clinics and USD 113,420 for pediatric. These numbers can show that these two cost centers had more staffs than other, a large number of patients who treated in these two cost centers can be a good reason for that.

Material cost

Material cost include cost of electricity, cost of water, cost of telephone, cost of chemical, cost of maintenance, cost of office material, and cost of cleaning. As mentioned in Chapter IV page 79, material costs were collected at administration department and don't have to calculated.

Table 5.4 Material cost of NRPPC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Material cost</i>
<i>Trade union office</i>	<i>NRPPC1</i>	<i>185</i>
<i>Rector board</i>	<i>NRPPC2</i>	<i>0</i>
<i>General planning</i>	<i>NRPPC3</i>	<i>793</i>
<i>Personnel</i>	<i>NRPPC4</i>	<i>297</i>
<i>Finance</i>	<i>NRPPC5</i>	<i>10,617</i>
<i>Administration</i>	<i>NRPPC6</i>	<i>3,103</i>
<i>Supply</i>	<i>NRPPC7</i>	<i>443</i>
<i>Nursing</i>	<i>NRPPC8</i>	<i>92</i>
<i>Direction of healthcare activities</i>	<i>NRPPC9</i>	<i>93</i>
<i>Nutrition</i>	<i>NRPPC10</i>	<i>84</i>
<i>Infectious control</i>	<i>NRPPC11</i>	<i>9,986</i>
<i>Total</i>		<i>25,693</i>

The result in table 5.4 shows that total material cost of NRPPC was USD 25,693. In which, finance and infectious control had higher material cost than other NRPPC which were USD 10,617 for finance and USD 9,986 for infectious control. And also from this table, there was no material cost for rector board. In most of material cost comes from cost of chemistry and cost of office material, that why rector board had no material cost.

Table 5.5 Material cost of RPCC of Thai Nguyen General Hospital in 2011

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Material cost</i>
<i>Hematology</i>	<i>RPCC1</i>	<i>148,691</i>
<i>Biochemistry</i>	<i>RPCC2</i>	<i>162,942</i>
<i>Microbiology</i>	<i>RPCC3</i>	<i>1,873</i>
<i>Radiology</i>	<i>RPCC4</i>	<i>94,459</i>
<i>Pathology</i>	<i>RPCC5</i>	<i>4,665</i>
<i>Pharmacy</i>	<i>RPCC6</i>	<i>3,327</i>
<i>Function exploration</i>	<i>RPCC7</i>	<i>9,440</i>
<i>Total</i>		<i>425,396</i>

The result in table 5.5 shows that the total material cost of RPCC was USD 425,396. In this table, material cost of biochemistry and hematology were higher than other RPCC which were USD 162,942 for biochemistry and USD 148,691 for hematology. Material cost of microbiology was the smallest (USD 1,873).

Table 5.6 Material cost of PS of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Material cost</i>
<i>Clinics</i>	<i>PS1</i>	<i>2,688</i>
<i>Intensive care</i>	<i>PS2</i>	<i>128,395</i>
<i>Cardiovascular internal</i>	<i>PS3</i>	<i>4,240</i>
<i>Internal 4</i>	<i>PS4</i>	<i>811</i>
<i>Neurology</i>	<i>PS5</i>	<i>1,770</i>
<i>Psychiatry</i>	<i>PS6</i>	<i>537</i>
<i>Orthopedic</i>	<i>PS7</i>	<i>15,653</i>
<i>Anesthetic</i>	<i>PS8</i>	<i>86,767</i>
<i>General surgery</i>	<i>PS9</i>	<i>4,252</i>
<i>Ophthalmology</i>	<i>PS10</i>	<i>3,499</i>
<i>ENT</i>	<i>PS11</i>	<i>1,897</i>
<i>Odonto - stomatology</i>	<i>PS12</i>	<i>5,353</i>
<i>Pediatric</i>	<i>PS13</i>	<i>6,616</i>
<i>Obstetric</i>	<i>PS14</i>	<i>13,264</i>
<i>Infectious</i>	<i>PS15</i>	<i>2,654</i>
<i>Rehabilitation</i>	<i>PS16</i>	<i>1,073</i>
<i>Traditional medicine</i>	<i>PS17</i>	<i>399</i>
<i>Oncology</i>	<i>PS18</i>	<i>4,651</i>
<i>Nuclear medicine</i>	<i>PS19</i>	<i>4,084</i>
<i>Respiration internal</i>	<i>PS20</i>	<i>4,313</i>
<i>Gastroenterology (include urology department)</i>	<i>PS21</i>	<i>4,184</i>

<i>Dermatology</i>	<i>PS22</i>	<i>552</i>
<i>Digestive surgical</i>	<i>PS23</i>	<i>4,259</i>
<i>Cardiovascular surgery</i>	<i>PS24</i>	<i>1,326</i>
<i>Total</i>		<i>303,235</i>

From table 5.6 we can see that total material cost of PS was USD 303,235. In general, material cost of PS was quite high. Material cost of intensive care and anesthetic were higher than other PS. Those costs were USD 128,395 for intensive care and USD 86,767 for anesthetic. The smallest material cost belonged to traditional medicine (USD 399).

Capital cost

Capital cost is the sum of capital cost of equipment and capital cost of building. To calculate the capital cost of equipment and capital cost of building, depreciation has to be conducted. Below here is the depreciation calculation of capital assets of Trade union center. Capital assets of other cost centers will be calculated similar with capital asset of trade union.

Capital cost of equipment

As mentioned in list of assumption applied in page 90, although some assets have useful life are eight years, this research still assume useful life of those assets were five years, because those assets were broken but still use in hospital. And some of assets have a low price than their actual price because those assets were support from equipment companies.

Table 5.7 Depreciation calculation of capital assets of Trade union department in 2011 (in USD)

USD 1 = 21036 VND

Cost center	Equipment	Original price (1)	Purchasing year (2)	IAF (3)	Replacement cost (4)=(1) x (3)	Useful life (t) (5)	Annuity Factor (6)	Capital cost in 2011(7)=(4)/(6)
Trade union	Computer	17	2010	0.85	14	5	4.58	3
	Computer	461	2010	0.85	392	5	4.58	86
	Printer	218	2010	0.85	186	5	4.58	41
	Computer	474	2011	1.00	474	5	4.58	104
	Printer	160	2011	1.00	160	5	4.58	35
	UPS 500VA	56	2011	1.00	56	5	4.58	12
	Table	38	2011	1.00	38	5	4.58	8
	Chair	28	2011	1.00	28	5	4.58	6
	Lioa	6	2011	1.00	6	5	4.58	1
	Total	1,458			1,354			296

Where

IAF: Inflation adjustment factor

IAF = consumer price index in analysis year / consumer price index in purchasing year

IAF between 2010 and 2011 = consumer price index in 2011/consumer price index in 2010

$$= 100.5/118.1 = 0.85$$

Consumer price index (CPI) can see at appendix 2 page 140.

Annuity factor = $[1-(1+r)^{-t}]/r$

r: interest rate = 0.03

t: useful life = 5

Annuity factor = $[1-(1+0.03)^{-5}]/0.03 = 4.58$

From table 5.7 we can see that there was deflation between 2010 and 2011, therefore the original price of equipments cannot use any more, the replacement cost of equipment was used in depreciation calculation. The replacement cost of equipment equal original price multiple with inflation adjustment factor. After that, capital cost of equipment in 2011 was estimated by dividing replacement cost to annuity factor. The total capital cost of trade union center was USD 296 in 2011. Capital cost of equipments of other cost centers was estimated similar with trade union center.

Below here is the sum of total capital cost of equipments in 2011 of cost centers after depreciation.

Table 5.8 Capital cost of equipment of NRPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost of equipment in 2011</i>
<i>Trade union office</i>	<i>NRPCC1</i>	<i>296</i>
<i>Rector board</i>	<i>NRPCC2</i>	<i>0</i>
<i>General planning</i>	<i>NRPCC3</i>	<i>79</i>
<i>Personnel</i>	<i>NRPCC4</i>	<i>4</i>
<i>Finance</i>	<i>NRPCC5</i>	<i>618</i>
<i>Administration</i>	<i>NRPCC6</i>	<i>1,092</i>
<i>Supply</i>	<i>NRPCC7</i>	<i>6,106</i>
<i>Nursing</i>	<i>NRPCC8</i>	<i>93</i>
<i>Direction of healthcare activities</i>	<i>NRPCC9</i>	<i>0</i>
<i>Nutrition</i>	<i>NRPCC10</i>	<i>0</i>
<i>Infectious control</i>	<i>NRPCC11</i>	<i>32,744</i>
<i>Total</i>		<i>41,032</i>

The result in table 5.8 shows that, in 2011, the total capital cost of equipment of NRPCC was USD 41,032. In which, infectious control had the highest capital cost of equipment which was USD 32,744; while there are three NRPCC had no capital

cost of equipment. Those three NRPCC had equipments, but equipments are purchased more than 20 years ago, those equipments are now out of date, and there is no data about original cost, purchase year and number of equipment, that why these equipments were not included in calculate cost of equipment.

Table 5.9 Capital cost of equipment of RPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost of equipment in 2011</i>
<i>Hematology</i>	<i>RPCC1</i>	<i>30,041</i>
<i>Biochemistry</i>	<i>RPCC2</i>	<i>40,356</i>
<i>Microbiology</i>	<i>RPCC3</i>	<i>4,961</i>
<i>Radiology</i>	<i>RPCC4</i>	<i>227,371</i>
<i>Pathology</i>	<i>RPCC5</i>	<i>14,252</i>
<i>Pharmacy</i>	<i>RPCC6</i>	<i>329</i>
<i>Function exploration</i>	<i>RPCC7</i>	<i>61,148</i>
<i>Total</i>		<i>378,458</i>

The result in table 5.9 shows that in 2011, the total capital cost of equipment of RPCC was USD 378,458. In which, radiology had the highest capital cost of equipment which was USD 227,371, while pharmacy had the smallest capital cost of equipment which was USD 329.

Table 5.10 Capital cost of equipment of PS of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost of equipment in 2011</i>
<i>Clinics</i>	<i>PS1</i>	<i>3,724</i>
<i>Intensive care</i>	<i>PS2</i>	<i>97,246</i>
<i>Cardiovascular internal</i>	<i>PS3</i>	<i>4,404</i>
<i>Internal 4</i>	<i>PS4</i>	<i>1,813</i>
<i>Neurology</i>	<i>PS5</i>	<i>508</i>

<i>Psychiatry</i>	<i>PS6</i>	<i>305</i>
<i>Orthopedic</i>	<i>PS7</i>	<i>3,684</i>
<i>Anesthetic</i>	<i>PS8</i>	<i>164,799</i>
<i>General surgery</i>	<i>PS9</i>	<i>2,657</i>
<i>Ophthalmology</i>	<i>PS10</i>	<i>26,773</i>
<i>ENT</i>	<i>PS11</i>	<i>7,316</i>
<i>Odonto - stomatology</i>	<i>PS12</i>	<i>15,513</i>
<i>Pediatric</i>	<i>PS13</i>	<i>44,381</i>
<i>Obstetric</i>	<i>PS14</i>	<i>8,058</i>
<i>Infectious</i>	<i>PS15</i>	<i>1,983</i>
<i>Rehabilitation</i>	<i>PS16</i>	<i>27,567</i>
<i>Traditional medicine</i>	<i>PS17</i>	<i>850</i>
<i>Oncology</i>	<i>PS18</i>	<i>31,869</i>
<i>Nuclear medicine</i>	<i>PS19</i>	<i>7,617</i>
<i>Respiration internal</i>	<i>PS20</i>	<i>11,754</i>
<i>Gastroenterology</i> <i>(include urology department)</i>	<i>PS21</i>	<i>2,754</i>
<i>Dermatology</i>	<i>PS22</i>	<i>833</i>
<i>Digestive surgical</i>	<i>PS23</i>	<i>383</i>
<i>Cardiovascular surgery</i>	<i>PS24</i>	<i>31,782</i>
<i>Total</i>		<i>498,574</i>

From table 5.10 we can see that in 2011, the total capital cost of equipment of PS was USD 498,574. The capital cost of equipment of Anesthetic and Intensive care were higher than other PS which were USD 164,799 for Anesthetic and USD 97,246 for Intensive care. The smallest capital cost of equipment belonged to Psychiatry which was USD 305 in 2011.

Capital cost of building

Capital cost of building was estimated similar with capital cost of asset. Below here is the depreciation calculation of building of Neurology center. Capital cost of building of other cost centers were estimated similar with building of Neurology center. Each cost center has its own building.

Table 5.11 Depreciation calculation of building of Neurology center in 2011

US\$ 1 = 21036 VND

Analysis year	2011						
Interest rate	0.03						
Cost center	Original price (1)	Purchasing year(2)	IAF(3)	Replacement cost (4)=(1)x(3)	Useful year (t) (5)	Annuity Factor(6)	Capital cost in 2011 (7)=(4)/(6)
Neurology	50,513	1998	1.01	50,781	25	17.41	2,916

Where

IAF is inflation adjustment factor

IAF = consumer price index in analysis year / consumer price index in purchasing year

IAF between 1998 and 2011 = consumer price index in 2011/consumer price index in 1998
= 100.5/100 = 1.01

Consumer price index can see in appendix 2 page 140.

Annuity factor = $[1-(1+r)^{-t}]/r$

r: interest rate = 0.03

t: useful life = 25

Annuity factor = $[1-(1+0.03)^{-25}]/0.03 = 17.41$

From table 5.11 we can see that, there was inflation between 1998 and 2011, therefore the original price of building cannot use any more, the replacement cost of building was used in depreciation calculation. The replacement cost of building equal original price of building multiple with inflation adjustment factor. After that, capital cost of building in 2011 was estimated by dividing replacement cost to annuity factor. The capital cost of building in 2011 of Neurology was US\$ 2,916. Capital cost of building of other cost centers was estimated similar with capital cost of building of Neurology. Below here is the capital cost of building in 2011 of cost centers.

Table 5.12 Capital cost of building of NRPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost of building in 2011</i>
<i>Trade union office</i>	<i>NRPCC1</i>	<i>447</i>
<i>Rector board</i>	<i>NRPCC2</i>	<i>1,318</i>
<i>General planning</i>	<i>NRPCC3</i>	<i>361</i>
<i>Personnel</i>	<i>NRPCC4</i>	<i>0</i>
<i>Finance</i>	<i>NRPCC5</i>	<i>596</i>
<i>Administration</i>	<i>NRPCC6</i>	<i>1,443</i>
<i>Supply</i>	<i>NRPCC7</i>	<i>788</i>
<i>Nursing</i>	<i>NRPCC8</i>	<i>149</i>
<i>Direction of healthcare activities</i>	<i>NRPCC9</i>	<i>289</i>
<i>Nutrition</i>	<i>NRPCC10</i>	<i>488</i>
<i>Infectious control</i>	<i>NRPCC11</i>	<i>592</i>
<i>Total</i>		<i>6,471</i>

The result in table 5.12 shows that total capital cost of building of NRPCC was USD 6,471. The capital cost of building of rector board and administration were higher than other NRPCC which were US\$ 1,318 for rector board and USD 1,443 for administration. From this table we can see that, the personnel cost center had no capital cost of building. The building of personnel was built more than 50 years ago, there is no data about original cost and year of build, that why this building was not included in data analysis.

Table 5.13 Capital cost of building of RPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost of building in 2011</i>
<i>Hematology</i>	<i>RPCC1</i>	<i>952</i>
<i>Biochemistry</i>	<i>RPCC2</i>	<i>952</i>
<i>Microbiology</i>	<i>RPCC3</i>	<i>800</i>
<i>Radiology</i>	<i>RPCC4</i>	<i>1,472</i>
<i>Pathology</i>	<i>RPCC5</i>	<i>0</i>
<i>Pharmacy</i>	<i>RPCC6</i>	<i>1,472</i>
<i>Function exploration</i>	<i>RPCC7</i>	<i>1,427</i>
<i>Total</i>		<i>7,076</i>

The result in table 5.13 shows that the total capital cost of building of RPCC was USD 7,076. In which, capital cost of building of pharmacy, function exploration and radiology were higher than other RPCC, the capital cost of those cost centers were USD 1,472. And the same problem with NRPCC, pathology had no capital cost of building because there is no data about original cost and year build of building of pathology.

Table 5.14 Capital cost of building of PS of Thai Nguyen General Hospital in 2011
(in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost of building in 2011</i>
<i>Clinics</i>	<i>PS1</i>	<i>15,440</i>
<i>Intensive care</i>	<i>PS2</i>	<i>2,855</i>
<i>Cardiovascular internal</i>	<i>PS3</i>	<i>0</i>
<i>Internal 4</i>	<i>PS4</i>	<i>0</i>
<i>Neurology</i>	<i>PS5</i>	<i>2,916</i>
<i>Psychiatry</i>	<i>PS6</i>	<i>306</i>
<i>Orthopedic</i>	<i>PS7</i>	<i>2,859</i>
<i>Anesthetic</i>	<i>PS8</i>	<i>5,318</i>
<i>General surgery</i>	<i>PS9</i>	<i>0</i>
<i>Ophthalmology</i>	<i>PS10</i>	<i>2,668</i>
<i>ENT</i>	<i>PS11</i>	<i>2,668</i>
<i>Odonto - stomatology</i>	<i>PS12</i>	<i>1,430</i>
<i>Pediatric</i>	<i>PS13</i>	<i>2,859</i>
<i>Obstetric</i>	<i>PS14</i>	<i>2,860</i>
<i>Infectious</i>	<i>PS15</i>	<i>1,808</i>
<i>Rehabilitation</i>	<i>PS16</i>	<i>3,272</i>
<i>Traditional medicine</i>	<i>PS17</i>	<i>2,668</i>
<i>Oncology</i>	<i>PS18</i>	<i>8,338</i>
<i>Nuclear medicine</i>	<i>PS19</i>	<i>2,289</i>
<i>Respiration internal</i>	<i>PS20</i>	<i>0</i>
<i>Gastroenterology (include urology department)</i>	<i>PS21</i>	<i>0</i>
<i>Dermatology</i>	<i>PS22</i>	<i>1,036</i>
<i>Digestive surgical</i>	<i>PS23</i>	<i>0</i>
<i>Cardiovascular surgery</i>	<i>PS24</i>	<i>0</i>
<i>Total</i>		<i>61,590</i>

The result in table 5.14 shows that, in 2011, the total capital cost of building of PS was USD 61,590. In which clinic had the highest capital cost of building while

there are some cost centers had no capital cost of building. The same problem with NRPCC and RPCC, those cost centers had building, but those buildings was built more than 50 years ago and there is no data about original price and year of build of those building.

Capital cost

The capital cost is the sum of capital cost of equipment and capital cost of building. Below here is the capital cost of three cost center groups.

Table 5.15 Capital cost of NRPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost in 2011</i>
<i>Trade union office</i>	<i>NRPCC1</i>	<i>743</i>
<i>Rector board</i>	<i>NRPCC2</i>	<i>1,318</i>
<i>General planning</i>	<i>NRPCC3</i>	<i>440</i>
<i>Personnel</i>	<i>NRPCC4</i>	<i>4</i>
<i>Finance</i>	<i>NRPCC5</i>	<i>1,214</i>
<i>Administration</i>	<i>NRPCC6</i>	<i>2,535</i>
<i>Supply</i>	<i>NRPCC7</i>	<i>6,894</i>
<i>Nursing</i>	<i>NRPCC8</i>	<i>242</i>
<i>Direction of healthcare activities</i>	<i>NRPCC9</i>	<i>289</i>
<i>Nutrition</i>	<i>NRPCC10</i>	<i>488</i>
<i>Infectious control</i>	<i>NRPCC11</i>	<i>33,336</i>
<i>Total</i>		<i>47,502</i>

From table 5.15 we can see that, the total capital cost of NRPCC was USD 47,502. In which infectious control had the highest capital cost which was USD 33,336 while the smallest capital cost belonged to personnel. Because personnel had no cost of building and most of equipment in personnel is out of date or no data about original price and purchase year, the capital cost of personnel was too low at USD 4.

Table 5.16 Capital cost of RPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost in 2011</i>
<i>Hematology</i>	<i>RPCC1</i>	<i>30,994</i>
<i>Biochemistry</i>	<i>RPCC2</i>	<i>41,309</i>
<i>Microbiology</i>	<i>RPCC3</i>	<i>5,761</i>
<i>Radiology</i>	<i>RPCC4</i>	<i>228,843</i>
<i>Pathology</i>	<i>RPCC5</i>	<i>14,252</i>
<i>Pharmacy</i>	<i>RPCC6</i>	<i>1,801</i>
<i>Function exploration</i>	<i>RPCC7</i>	<i>62,575</i>
<i>Total</i>		<i>385,534</i>

The result on table 5.16 shows that total capital cost was USD 385,534. In which, capital cost of radiology is higher than other RPCC which was USD 228,843 while pharmacy had the smallest capital cost which was USD 1,801

Table 5.17 Capital cost of PS of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Capital cost in 2011</i>
<i>Clinics</i>	<i>PS1</i>	<i>19,163</i>
<i>Intensive care</i>	<i>PS2</i>	<i>100,101</i>
<i>Cardiovascular internal</i>	<i>PS3</i>	<i>4,404</i>
<i>Internal 4</i>	<i>PS4</i>	<i>1,813</i>
<i>Neurology</i>	<i>PS5</i>	<i>3,424</i>
<i>Psychiatry</i>	<i>PS6</i>	<i>611</i>
<i>Orthopedic</i>	<i>PS7</i>	<i>6,544</i>
<i>Anesthetic</i>	<i>PS8</i>	<i>170,118</i>
<i>General surgery</i>	<i>PS9</i>	<i>2,657</i>
<i>Ophthalmology</i>	<i>PS10</i>	<i>29,441</i>
<i>ENT</i>	<i>PS11</i>	<i>9,984</i>
<i>Odonto - stomatology</i>	<i>PS12</i>	<i>16,943</i>
<i>Pediatric</i>	<i>PS13</i>	<i>47,240</i>
<i>Obstetric</i>	<i>PS14</i>	<i>10,918</i>
<i>Infectious</i>	<i>PS15</i>	<i>3,791</i>
<i>Rehabilitation</i>	<i>PS16</i>	<i>30,839</i>
<i>Traditional medicine</i>	<i>PS17</i>	<i>3,518</i>
<i>Oncology</i>	<i>PS18</i>	<i>40,207</i>
<i>Nuclear medicine</i>	<i>PS19</i>	<i>9,906</i>
<i>Respiration internal</i>	<i>PS20</i>	<i>11,754</i>
<i>Gastroenterology (include urology department)</i>	<i>PS21</i>	<i>2,754</i>
<i>Dermatology</i>	<i>PS22</i>	<i>1,869</i>
<i>Digestive surgical</i>	<i>PS23</i>	<i>383</i>
<i>Cardiovascular surgery</i>	<i>PS24</i>	<i>31,782</i>
<i>Total</i>		<i>560,164</i>

From table 5.17 we can see that the total capital cost of PS was USD 560,164. In which capital cost of intensive care and anesthetic were higher than other PS which was USD 100,101 for intensive care and USD 170,118 for anesthetic. The lowest capital cost belonged to digestive surgical which was USD 383.

Total direct cost

Total direct cost of cost center is the sum of labor cost, material cost and capital cost. Below here is the total direct cost of three cost center groups.

Table 5.18 Direct cost of NRPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Labor cost (from table 5.1) (1)</i>	<i>Material cost (from table 5.4) (2)</i>	<i>Capital cost (from table 5.15) (3)</i>	<i>Direct cost (1)+(2)+(3)</i>
<i>Trade union office</i>	<i>NRPCC1</i>	<i>0</i>	<i>185</i>	<i>743</i>	<i>928</i>
<i>Rector board</i>	<i>NRPCC2</i>	<i>15,973</i>	<i>0</i>	<i>1,318</i>	<i>17,291</i>
<i>General planning</i>	<i>NRPCC3</i>	<i>31,687</i>	<i>793</i>	<i>440</i>	<i>32,919</i>
<i>Personnel</i>	<i>NRPCC4</i>	<i>47,311</i>	<i>297</i>	<i>4</i>	<i>47,613</i>
<i>Finance</i>	<i>NRPCC5</i>	<i>35,497</i>	<i>10,617</i>	<i>1,214</i>	<i>47,329</i>
<i>Administration</i>	<i>NRPCC6</i>	<i>68,224</i>	<i>3,103</i>	<i>2,535</i>	<i>73,862</i>
<i>Supply</i>	<i>NRPCC7</i>	<i>30,881</i>	<i>443</i>	<i>6,894</i>	<i>38,219</i>
<i>Nursing</i>	<i>NRPCC8</i>	<i>14,858</i>	<i>92</i>	<i>242</i>	<i>15,192</i>
<i>Direction of healthcare activities</i>	<i>NRPCC9</i>	<i>5,489</i>	<i>93</i>	<i>289</i>	<i>5,871</i>
<i>Nutrition</i>	<i>NRPCC10</i>	<i>8,280</i>	<i>84</i>	<i>488</i>	<i>8,851</i>
<i>Infectious control</i>	<i>NRPCC11</i>	<i>45,410</i>	<i>9,986</i>	<i>33,336</i>	<i>88,733</i>
<i>Total</i>		<i>303,610</i>	<i>25,693</i>	<i>47,502</i>	<i>376,806</i>

The result in table 5.18 shows that the total direct cost of NRPCC was USD 376,806. In which direct cost of administration and infectious control were higher than other NRPCC which were USD 73,862 for administration and USD 88,733 for infectious control. Trade union office had a lowest direct cost which was USD 928. Trade union office had no labor cost, therefore direct cost of this cost center came from capital cost and material cost.

Table 5.19 Direct cost of RPCC of Thai Nguyen General Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Labor cost (come from table 5.2) (1)</i>	<i>Material cost (come from table 5.5) (2)</i>	<i>Capital cost (come from table 5.16) (3)</i>	<i>Direct cost (4)= (1)+(2)+(3)</i>
<i>Hematology</i>	<i>RPCC1</i>	47,441	148,691	30,994	227,126
<i>Biochemistry</i>	<i>RPCC2</i>	23,416	162,942	41,309	227,667
<i>Microbiology</i>	<i>RPCC3</i>	14,256	1,873	5,761	21,890
<i>Radiology</i>	<i>RPCC4</i>	45,990	94,459	228,843	369,291
<i>Pathology</i>	<i>RPCC5</i>	17,622	4,665	14,252	36,539
<i>Pharmacy</i>	<i>RPCC6</i>	41,029	3,327	1,801	46,156
<i>Function exploration</i>	<i>RPCC7</i>	38,018	9,440	62,575	110,033
<i>Total</i>		227,771	425,396	385,534	1.038,701

From table 5.19 we can see that total direct cost of RPCC was USD 1,038,701. In which direct cost of radiology, hematology and biochemistry were higher than other RPCC which were USD 369,291 for radiology, USD 227,126 for hematology and USD 227,667 for biochemistry. The direct cost of microbiology was lowest at USD 21,890.

Table 5.20 Direct cost of PS of Thai Nguyen general Hospital in 2011 (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Labor cost (comes from table 5.3) (1)</i>	<i>Material cost (comes from table 5.6) (2)</i>	<i>Capital cost (comes from table 5.17) (3)</i>	<i>Direct cost (4)=(1)+(2)+(3)</i>
<i>Clinics</i>	<i>PS1</i>	103,942	2,688	19,163	125,793
<i>Intensive care</i>	<i>PS2</i>	72,850	128,395	100,101	301,346
<i>Cardiovascular internal</i>	<i>PS3</i>	44,406	4,240	4,404	53,049
<i>Internal 4</i>	<i>PS4</i>	28,981	811	1,813	31,605
<i>Neurology</i>	<i>PS5</i>	38,164	1,770	3,424	43,358
<i>Psychiatry</i>	<i>PS6</i>	30,298	537	611	31,446
<i>Orthopedic</i>	<i>PS7</i>	66,631	15,653	6,544	88,827
<i>Anesthetic</i>	<i>PS8</i>	53,378	86,767	170,118	310,263
<i>General surgery</i>	<i>PS9</i>	52,449	4,252	2,657	59,359
<i>Ophthalmology</i>	<i>PS10</i>	38,084	3,499	29,441	71,024
<i>ENT</i>	<i>PS11</i>	27,463	1,897	9,984	39,345
<i>Odonto - stomatology</i>	<i>PS12</i>	40,438	5,353	16,943	62,734
<i>Pediatric</i>	<i>PS13</i>	113,420	6,616	47,240	167,276
<i>Obstetric</i>	<i>PS14</i>	74,092	13,264	10,918	98,274
<i>Infectious</i>	<i>PS15</i>	30,800	2,654	3,791	37,245

<i>Rehabilitation</i>	<i>PS16</i>	<i>40,002</i>	<i>1,073</i>	<i>30,839</i>	<i>71,914</i>
<i>Traditional medicine</i>	<i>PS17</i>	<i>21,993</i>	<i>399</i>	<i>3,518</i>	<i>25,910</i>
<i>Oncology</i>	<i>PS18</i>	<i>52,465</i>	<i>4,651</i>	<i>40,207</i>	<i>97,323</i>
<i>Nuclear medicine</i>	<i>PS19</i>	<i>25,138</i>	<i>4,084</i>	<i>9,906</i>	<i>39,129</i>
<i>Respiration internal</i>	<i>PS20</i>	<i>40,940</i>	<i>4,313</i>	<i>11,754</i>	<i>57,006</i>
<i>Gastroenterology</i> <i>(include urology</i> <i>department)</i>	<i>PS21</i>	<i>42,196</i>	<i>4,184</i>	<i>2,754</i>	<i>49,134</i>
<i>Dermatology</i>	<i>PS22</i>	<i>23,672</i>	<i>552</i>	<i>1,869</i>	<i>26,093</i>
<i>Digestive surgical</i>	<i>PS23</i>	<i>56,226</i>	<i>4,259</i>	<i>383</i>	<i>60,868</i>
<i>Cardiovascular surgery</i>	<i>PS24</i>	<i>16,573</i>	<i>1,326</i>	<i>31,782</i>	<i>49,681</i>
<i>Total</i>		<i>1,134,602</i>	<i>303,235</i>	<i>560,164</i>	<i>1,998,001</i>

From table 5.20 we can see that the total direct cost of PS was USD 1,998,001. In which the direct cost of intensive care, clinics, anesthetic and pediatric were higher than other PS which were USD 301,346 for intensive care, USD 125,793 for clinics, USD 310,263 for anesthetic and USD 167,276 for pediatric. The direct cost of traditional medicine and dermatology was smaller than other PS which was USD 25,910 for traditional medicine and USD 26,093 for dermatology.

Table 5.21 Direct cost of cost centers follow cost component (in USD)

USD 1 = 21036 VND

	<i>Labor cost</i> <i>(come(1))</i>	<i>Material cost(2)</i>	<i>Capital cost(3)</i>	<i>Direct cost</i> <i>(4)=(1)+(2)+(3)</i>
<i>Cost</i>	<i>1,665,98</i>	<i>754,324</i>	<i>993,200</i>	<i>3,413,508</i>
<i>%</i>	<i>49</i>	<i>22</i>	<i>29</i>	<i>100</i>

Where

Labor cost (1) is sum of total labor cost of NRPCC, RPCC and PS

Labor cost (1) = Total labor cost of NRPCC (from table 5.18) + total labor cost of RPCC (from table 5.19) + total labor cost of PS (from table 5.20)

$$= \$ 303,610 + \$227,771 + 1,134,602 = 1,665,984$$

Material cost (2) is sum of total material cost of NRPCC, RPCC and PS

Material cost (2) = Total material cost of NRPC (from table 5.18) + total material cost of RPCC (from table 5.19) + total material cost of PS (from table 5.20)

$$= \$25,693 + \$425,396 + \$303,235 = \$754,324$$

Capital cost (3) is sum of total capital cost of NRPCC, RPCC and PS

Capital cost (3) = Total capital cost of NRPCC (from table 5.18) + total capital cost of RPCC (from table 5.19) + total capital cost of PS (from table 20)

Capital cost (3) = \$47,502 + \$385,534 + \$560,164 = \$993200

The result in table 5.21 shows that the total direct cost of all cost centers was USD 3,413,508. In which labor cost was highest which was at USD 1,665,984 (49%). Material cost and capital cost were quite similar which were USD 754,324 (22%) for material cost and USD 993,200 (29%) for capital cost.

Table 5.22 Direct cost of cost centers follow cost center groups (in USD)

USD 1 = 21036 VND

	<i>NRPCC(comes from table 18)(1)</i>	<i>RPCC(comes from table 19)(2)</i>	<i>PS(comes from table 20)(3)</i>	<i>Direct cost (4)=(1)+(2)+(3)</i>
<i>Cost</i>	<i>376,806</i>	<i>1,038,701</i>	<i>1,998,001</i>	<i>3,413,508</i>
<i>%</i>	<i>11</i>	<i>30</i>	<i>59</i>	<i>100</i>

From table 5.22 we can see that the total direct cost of all cost centers was USD 3,413,508. In which PS had the highest direct cost which was USD 1,998,001 (59%) while NRPCC had the lowest direct cost which was USD 376,806 (11%).

5.2 Full cost of patient service centers in Thai Nguyen General Hospital

In this research, step-down cost allocation method was used to allocate cost from NRPCC to RPCC and PS

Firstly, direct cost of NRPCC was allocated to RPCC and PS based on allocation criteria in table 4.3 page 87.

Secondly, cost of RPCC which include direct cost of RPCC and indirect cost came from direct cost of NRPCC was allocated to PS.

The step-down allocation method was described in table below:

Table 5.23 Step-down allocation method

Cost center	Code	Total direct cost	Cost allocation of trade union	Cost allocation of rector board	Cost allocation of general planning	Cost allocation of personnel	Cost allocation of finance	Cost allocation of administration	Cost allocation of supply	Cost allocation of nursing	Cost allocation of direction of healthcare activities	Cost allocation of nutrition	Cost allocation of infectious control	Cost allocation of pharmacy
Trade union office	NRPC C1	928	0	0	0	0	0	0	0	0	0	0	0	0
Rector board	NRPC C2	17,291	17,295	0	0	0	0	0	0	0	0	0	0	0
General planning	NRPC C3	32,919	32,938	33,303.8969	0	0	0	0	0	0	0	0	0	0
Personnel	NRPC C4	47,613	47,638	48,117.9211	49,061.7562	0	0	0	0	0	0	0	0	0
Finance	NRPC C5	47,329	47,353	47,809.8625	48,708.7531	50,071.5797	0	0	0	0	0	0	0	0
Administration	NRPC C6	73,862	73,902	74,656.0772	76,139.2467	78,387.9105	80,748	0	0	0	0	0	0	0
Supply	NRPC C7	38,219	38,233	38,507.3417	39,046.6761	39,864.372	40,723	42,175	0	0	0	0	0	0
Nursing	NRPC C8	15,192	15,198	15,312.0725	15,536.7951	15,877.5018	16,235	16,840	16,851	0	0	0	0	0
Direction of healthcare activities	NRPC C9	5,871	5,874	5,942.76123	6,077.59482	6,282.0188	6,497	6,860	6,872	6,872	0	0	0	0
Nutrition	NRPC C10	8,851	8,855	8,923.64306	9,058.47665	9,262.90063	9,477	9,841	9,862	9,862	9,862	0	0	0
Infectious control	NRPC C11	88,733	88,762	89,310.7022	90,389.3709	92,024.7628	93,742	96,647	98,082	98,082	98,082	98,449	0	0
Hematology	RPCC 1	227,126	227,155	227,703.29	22,8781.959	230,417.351	232,134	235,040	236,373	236,373	236,373	236,741	236,741	236,741
Biochemistry	RPCC 2	227,667	227,680	22,7931.38	22,8425.77	229,175.324	229,962	231,294	233,072	233,072	233,072	233,240	233,240	233,240
Microbiology	RPCC 3	21,890	21,898	22,058.4129	22,373.0246	22,850.0139	23,351	24,198	24,446	24,446	24,446	24,553	24,553	24,553
Radiology	RPCC 4	369,291	369,318	369,820.786	370,809.566	372,308.675	373,882	376,546	386,394	386,394	386,394	386,731	386,731	386,731
Pathology	RPCC 5	36,539	36,548	36,707.5059	37,022.1176	37,499.1069	38,000	38,847	39,461	39,461	39,461	39,568	39,568	39,568
Pharmacy	RPCC 6	46,156	46,181	46,661.1106	47,604.9458	49,035.9136	50,538	53,080	53,158	53,158	53,158	53,479	53,479	0
Function exploration	RPCC 7	110,033	110,057	110,514.23	111,413.121	112,775.947	114,207	116,628	119,321	119,321	119,321	119,627	119,627	119,627
Clinics	PS1	125,793	125,851	126,947.812	129,105.149	132,375.933	135,809	141,620	142,445	142,644	142,725	143,460	144,622	144,824
Intensive care	PS2	301,346	301,391	302,236.141	303,899.088	306,420.317	309,067	313,546	317,854	318,555	318,840	319,407	323,500	329,241
Cardiovascular internal	PS3	53,049	53,081	53,675.0093	54,843.5671	56,615.2416	58,475	61,623	61,812	62,753	63,137	63,535	69,031	71,810
Internal 4	PS4	31,605	31,619	31,893.58	32,432.9144	33,250.6103	34,109	35,562	35,640	35,978	36,115	36,299	38,272	39,677
Neurology	PS5	43,358	43,382	43,815.7362	44,669.6823	45,964.3676	47,323	49,624	49,771	50,376	50,622	50,913	54,446	56,305
Psychiatry	PS6	31,446	31,461	31,734.9952	32,274.3296	33,092.0255	33,950	35,403	35,429	35,714	35,830	36,014	37,678	38,823
Orthopedic	PS7	88,827	88,868	89,645.2998	91,173.4138	93,490.2189	95,922	100,038	100,320	101,486	101,961	102,482	109,294	112,709
Anesthetic	PS8	310,263	310,294	310,888.251	312,056.809	313,828.483	315,688	318,836	326,157	326,232	326,262	326,661	327,099	327,274
General surgery	PS9	59,359	59,388	59,936.3186	61,014.9874	62,650.3792	64,367	67,273	67,387	68,585	69,073	69,440	76,437	79,543

Ophthalmology	PS10	71,024	71,046	71,456.8821	72,265.8837	73,492.4276	74,780	76,959	78,226	78,512	78,628	78,904	80,573	81,536
ENT	PS11	39,345	39,360	39,657.4117	40,241.6906	41,127.5279	42,057	43,631	44,061	44,612	44,837	45,036	48,257	50,071
Odontostomatology	PS12	62,734	62,757	63,191.5469	64,045.4929	65,340.1782	66,699	68,999	69,729	70,059	70,193	70,484	72,414	73,561
Pediatric	PS13	167,276	167,315	168,046.307	169,484.532	171,665.055	173,954	177,828	179,861	181,708	182,462	182,952	193,744	197,960
Obstetric	PS14	98,274	98,313	99,044.3032	100,482.528	102,663.051	104,952	108,826	109,296	112,319	113,551	114,041	131,701	136,862
Infectious	PS15	37,245	37,259	37,533.3112	38,072.6456	38,890.3415	39,749	41,201	41,365	41,932	42,164	42,347	45,663	47,395
Rehabilitation	PS16	71,914	71,935	72,323.449	73,087.506	74,245.9086	75,462	77,520	78,847	79,273	79,446	79,707	82,194	85,700
Traditional medicine	PS17	25,910	25,922	26,150.8283	26,600.2736	27,281.6869	27,997	29,208	29,359	29,664	29,788	29,941	31,722	33,072
Oncology	PS18	97,323	97,357	97,997.1905	99,255.6374	101,163.595	103,166	106,556	108,286	109,273	109,675	110,104	115,868	120,366
Nuclear medicine	PS19	39,129	39,145	39,441.5726	40,025.8515	40,911.6887	41,842	43,415	43,842	44,101	44,206	44,405	45,918	46,729
Respiration internal	PS20	57,006	57,032	57,511.4922	58,455.3273	59,886.2952	61,388	63,931	64,437	65,145	65,435	65,756	69,898	72,001
Gastroenterology (include urology)	PS21	49,134	49,160	49,639.8778	50,583.7129	52,014.6808	53,517	56,059	56,178	57,042	57,394	57,716	62,763	65,407
Dermatology	PS22	26,093	26,107	26,358.0883	26,852.4781	27,602.0327	28,389	29,721	29,801	30,195	30,355	30,524	32,823	33,974
Digestive surgical	PS23	60,868	60,886	61,228.6786	61,902.8466	62,924.9665	63,998	65,814	65,830	66,402	66,636	66,865	70,208	71,973
Cardiovascular surgery	PS24	49,681	49,690	49,873.1685	50,232.7247	50,777.8554	51,350	52,319	53,686	53,912	54,004	54,126	55,444	56,236

The process of step-down cost allocation was described on chapter II from page 22 to page 33. From table 5.23 we can see that there was a total of twelve times distribution. First, direct cost of eleven NRPCC was allocated to RPCC and PS. Second, cost of one RPCC (pharmacy) was allocated to PS. As mentioned in chapter III page 73, cost of other RPCC: hematology, biochemistry, microbiology, pathology, radiology, function exploration will not be allocated to PS. After allocation, full cost of PS equal direct cost of PS plus indirect cost came from direct cost of NRPCC plus indirect cost came from cost of RPCC which included direct cost of RPCC and indirect cost came from NRPCC.

Cost allocation from NRPCC to RPCC and PS

Table 5.24 Cost of RPCC after receiving cost from NRPCC (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Direct cost(comes from table 19) (1)</i>	<i>Cost after receiving cost from NRPCC(comes from table 5.23)(2)=(1)+(3)</i>	<i>Cost was allocated from NRPCC (3)</i>
<i>Hematology</i>	<i>RPCC1</i>	227,126	236,741	9,615
<i>Biochemistry</i>	<i>RPCC2</i>	227,667	233,240	5,573
<i>Microbiology</i>	<i>RPCC3</i>	21,890	24,553	2,663
<i>Radiology</i>	<i>RPCC4</i>	369,291	386,731	17,439
<i>Pathology</i>	<i>RPCC5</i>	36,539	39,568	3,029
<i>Pharmacy</i>	<i>RPCC6</i>	46,156	53,479	7,324
<i>Function exploration</i>	<i>RPCC7</i>	110,033	119,627	9,594
<i>Total</i>		1,038,701	1,093,939	55,238

The result in table 5.24 shows that total cost which RPCC received from direct cost of NRPCC was USD 55,238. In which radiology had the highest indirect cost came from direct cost of NRPCC which was USD 17,439 and Microbiology had the lowest indirect cost came from NRPCC which was USD 2,663. After receiving

indirect cost at USD 55,238 came from direct cost of NRPCC, cost of RPCC was USD 1,093,939.

Table 5.25 Cost of PS after receiving cost from NRPCC

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Direct cost (comes from table 5.20) (1)</i>	<i>Total cost after receiving cost from NRPCC(comes from table 5.23)(2)=(1)+(3)</i>	<i>Cost was allocated from NRPCC (3)</i>
<i>Clinics</i>	<i>PS1</i>	125,793	144,622	18,830
<i>Intensive care</i>	<i>PS2</i>	301,346	323,500	22,154
<i>Cardiovascular internal</i>	<i>PS3</i>	53,049	69,031	15,981
<i>Internal 4</i>	<i>PS4</i>	31,605	38,272	6,668
<i>Neurology</i>	<i>PS5</i>	43,358	54,446	11,087
<i>Psychiatry</i>	<i>PS6</i>	31,446	37,678	6,232
<i>Orthopedic</i>	<i>PS7</i>	88,827	109,294	20,467
<i>Anesthetic</i>	<i>PS8</i>	310,263	327,099	16,837
<i>General surgery</i>	<i>PS9</i>	59,359	76,437	17,079
<i>Ophthalmology</i>	<i>PS10</i>	71,024	80,573	9,549
<i>ENT</i>	<i>PS11</i>	39,345	48,257	8,912
<i>Odonto - stomatology</i>	<i>PS12</i>	62,734	72,414	9,680
<i>Pediatric</i>	<i>PS13</i>	167,276	193,744	26,468
<i>Obstetric</i>	<i>PS14</i>	98,274	131,701	33,427
<i>Infectious</i>	<i>PS15</i>	37,245	45,663	8,418
<i>Rehabilitation</i>	<i>PS16</i>	71,914	82,194	10,280
<i>Traditional medicine</i>	<i>PS17</i>	25,910	31,722	5,812
<i>Oncology</i>	<i>PS18</i>	97,323	115,868	18,545
<i>Nuclear medicine</i>	<i>PS19</i>	39,129	45,918	6,790
<i>Respiration internal</i>	<i>PS20</i>	57,006	69,898	12,892
<i>Gastroenterology (include urology department)</i>	<i>PS21</i>	49,134	62,763	13,629
<i>Dermatology</i>	<i>PS22</i>	26,093	32,823	6,730
<i>Digestive surgical</i>	<i>PS23</i>	60,868	70,208	9,340
<i>Cardiovascular surgery</i>	<i>PS24</i>	49,681	55,444	5,764
<i>Total</i>		1,998,001	2,319,569	321,568

From table 5.25 we can see that total cost was allocated from NRPCC to PS was USD 321,568. In which cost was allocated from NRPCC to intensive care, orthopedic, pediatric and obstetric were higher than other PS, those cost were USD 22,154 for intensive care; USD 20,467 for orthopedic, USD 26,468 for pediatric and USD 33,427 for obstetric. After receiving indirect cost at USD 321,568 came from direct cost of NRPCC, cost of PS was at USD 2,319,569.

Cost allocation from RPCC to PS

Cost was allocated from RPCC to PS similar with NRPCC. As mentioned in chapter III page 73, cost of cost centers: hematology, biochemistry, microbiology, radiology, pathology and function exploration will not be allocated to PS. Only pharmacy which is RPCC allocated cost to PS.

Table 5.26 Cost of PS after receiving cost from RPCC (in USD)

USD 1 = 21036 VND

<i>Cost center</i>	<i>Code</i>	<i>Total cost after receiving cost from NRPCC (come from table 5.25) (1)</i>	<i>Full cost of PS(comes from table 5.23) (2) = (1)+(3)</i>	<i>Cost was allocated from RPCC (3)</i>
<i>Clinics</i>	<i>PS1</i>	<i>144,622</i>	<i>144,824</i>	<i>202</i>
<i>Intensive care</i>	<i>PS2</i>	<i>323,500</i>	<i>329,241</i>	<i>5,742</i>
<i>Cardiovascular internal</i>	<i>PS3</i>	<i>69,031</i>	<i>71,810</i>	<i>2,779</i>
<i>Internal 4</i>	<i>PS4</i>	<i>38,272</i>	<i>39,677</i>	<i>1,405</i>
<i>Neurology</i>	<i>PS5</i>	<i>54,446</i>	<i>56,305</i>	<i>1,860</i>
<i>Psychiatry</i>	<i>PS6</i>	<i>37,678</i>	<i>38,823</i>	<i>1,145</i>
<i>Orthopedic</i>	<i>PS7</i>	<i>109,294</i>	<i>112,709</i>	<i>3,416</i>
<i>Anesthetic</i>	<i>PS8</i>	<i>327,099</i>	<i>327,274</i>	<i>175</i>
<i>General surgery</i>	<i>PS9</i>	<i>76,437</i>	<i>79,543</i>	<i>3,106</i>
<i>Ophthalmology</i>	<i>PS10</i>	<i>80,573</i>	<i>81,536</i>	<i>963</i>
<i>ENT</i>	<i>PS11</i>	<i>48,257</i>	<i>50,071</i>	<i>1,814</i>
<i>Odonto - stomatology</i>	<i>PS12</i>	<i>72,414</i>	<i>73,561</i>	<i>1,147</i>
<i>Pediatric</i>	<i>PS13</i>	<i>193,744</i>	<i>197,960</i>	<i>4,216</i>
<i>Obstetric</i>	<i>PS14</i>	<i>131,701</i>	<i>136,862</i>	<i>5,161</i>
<i>Infectious</i>	<i>PS15</i>	<i>45,663</i>	<i>47,395</i>	<i>1,732</i>
<i>Rehabilitation</i>	<i>PS16</i>	<i>82,194</i>	<i>85,700</i>	<i>3,506</i>
<i>Traditional medicine</i>	<i>PS17</i>	<i>31,722</i>	<i>33,072</i>	<i>1,350</i>
<i>Oncology</i>	<i>PS18</i>	<i>115,868</i>	<i>120,366</i>	<i>4,497</i>
<i>Nuclear medicine</i>	<i>PS19</i>	<i>45,918</i>	<i>46,729</i>	<i>811</i>
<i>Respiration internal</i>	<i>PS20</i>	<i>69,898</i>	<i>72,001</i>	<i>2,103</i>
<i>Gastroenterology (include urology department)</i>	<i>PS21</i>	<i>62,763</i>	<i>65,407</i>	<i>2,644</i>
<i>Dermatology</i>	<i>PS22</i>	<i>32,823</i>	<i>33,974</i>	<i>1,150</i>
<i>Digestive surgical</i>	<i>PS23</i>	<i>70,208</i>	<i>71,973</i>	<i>1,765</i>
<i>Cardiovascular surgery</i>	<i>PS24</i>	<i>55,444</i>	<i>56,236</i>	<i>792</i>
<i>Total</i>		<i>2,319,569</i>	<i>2,373,049</i>	<i>53,479</i>

The result in table 5.26 shows that, total cost was allocated from RPCC to PS was at USD 53,479 which included direct cost of pharmacy and indirect cost came from NRPPCC. After receiving indirect cost at USD 53, 479 came from cost of pharmacy (include direct cost of pharmacy and indirect cost come from direct cost of NRPPCC), total full cost of PS was at USD 2,373,049. In which cost of gastroenterology which includes urology department was at USD 65,407.

5.3 Unit cost of inpatient services at urology department in Thai Nguyen General Hospital

Urology department belongs to gastroenterology. As mentioned in scope of study in page 4, this research focused on kidney related services only, and other diseases which are not related to kidney will be not include in research. And this research just used number of inpatient days of patients who have kidney related services was a criteria for allocate cost of gastroenterology to urology department.

Table 5.27 Number of inpatient days of gastroenterology and urology

<i>Cost center</i>	<i>Number of inpatient days</i>	<i>%</i>
<i>Gastroenterology</i>	<i>19,237</i>	<i>100</i>
<i>Urology department</i>	<i>6,016</i>	<i>31</i>
<i>Other</i>	<i>13,221</i>	<i>69</i>

The result in table 5.27 shows that the number of inpatient days of urology was 6.016 in 2011 and took 31% of total number of inpatient days of gastroenterology. Therefore, the total cost of urology department was equal

$$\begin{aligned} \text{Total cost of urology} &= 31\% \times \text{full cost of gastroenterology (come from table 5.26)} \\ &= 31\% \times \$65,407 = \$ 20,455 \end{aligned}$$

Therefore, the unit cost of inpatient services at urology department was calculated by this formula

$$\begin{aligned} \text{Unit cost of inpatient service} &= \frac{\text{Total cost of urology}}{\text{Number of inpatient days}} \\ &= \frac{\$20,455}{6016} = \$ 3.4 \end{aligned}$$

The unit cost of inpatient service at urology department was USD 3.4. Following the general partial user – fee for one inpatient service at hospital level I which is VND 10,000 per day equal USD 0.47 per day (Ministry of Health Vietnam, 1995) we can find out the gap between the unit cost of inpatient service at urology department and the partial user – fee for one patient service.

Table 5.28 The gap between the unit cost of inpatient service and the partial user – fee for one inpatient service

US\$ 1 = 21036 VND

	<i>Unit cost of inpatient service</i>	<i>Partial user-fee for one inpatient service</i>
<i>Cost</i>	<i>3.4</i>	<i>0.47</i>
<i>Rate</i>	<i>7.23</i>	

Where

$$\begin{aligned} \text{Rate} &= \frac{\text{Unit cost of inpatient service}}{\text{Partial user-fee for one inpatient service}} \\ &= 3.4/0.47 = 7.23 \end{aligned}$$

From table 5.28 we can see that the unit cost of inpatient service was 7.23 times higher than partial user-fee for one inpatient service.

Sensitivity analysis

From the result of research we found that the unit cost of inpatient service at urology department was USD 3.4. This unit cost was 7.23 times higher than partial user-fee. The result we had from this research base on some assumptions such as we assume that opportunity cost of land will not included in this study, assume that certain life of equipment will be five years for office equipment and medical equipment; assume that cost of Para-clinic centers will not allocated to patient services. The purpose of doing sensitivity analysis is we would like to see how the result of our research would be affected if we change assumptions, for example how the result would be affected if the certain life of equipment is seven years instead five years, this mean we make the useful life of equipments are longer than before; or how the result would be affected if the cost of Para-clinic centers were allocated to patient services.

From sensitivity analysis we found that if we change the curtain life of equipment is seven years instead five years, the unit cost of inpatient service at urology department will change from USD 3.4 to USD 3 and this unit cost will 7 times higher than partial user-fee.

From sensitivity analysis we also found that if we allocate cost of Para-clinic centers to patient service centers, the unit cost of inpatient service at urology department will change from USD 3.4 to USD 6 and this unit cost will 12.8 times higher than partial user-fee.

The detail calculation of sensitivity analysis can see in Appendix 3 page 142

CHAPTER VI

DISCUSSION AND CONCLUSION

6.1 Conclusion and discussion

The research on “The analysis of unit cost of in-patient services at the urology department in Thai Nguyen General Hospital in Vietnam” at least estimated the unit cost of providing health care, this information is very necessary for hospital management and health policy in Vietnam. This research focused on urology department because the number of patients with kidney disease in Vietnam is going up sharply. And this is the first research on unit cost of inpatient services of urology department in Vietnam. From this research, the gap between the unit cost of inpatient service and the partial user-fee for one inpatient service was estimated clearly.

In this research, data of cost will be analyzed to get the total direct cost of each cost center. After that all total direct cost of NRPPC and RPCC were allocated to PS based on allocation criteria. Step-down cost allocation method was used to allocate cost among cost centers. After having a total cost of urology department, unit cost of inpatient services was calculated by dividing total cost of urology department to total number of inpatients days.

Total direct cost

According to the result in chapter V, this study found that the total direct cost of all cost center of Thai Nguyen General Hospital in 2011 was USD 3,413,508 in which labor cost was USD 1,665,984; material cost was USD 754,324 and capital cost was USD 993,200. From the result in table 5.21 we can see that, the percentage in total direct cost of labor cost was the highest which was 49% while material cost and

capital cost were quite similar (22% and 29%). The result of this study is similar with previous studies such as research was conducted by Tan showed that direct labor cost was the major cost of hospital (Tan et al, 2010) and research was carried out by Dung and Flessa also showed that salaries and allowances were the largest budget expenditure (Dung, and Flessa, 2004).

The result in table 5.21 also shows that, capital cost of Thai Nguyen General Hospital in 2011 was not a high number, the percentage of capital cost was 29%. Capital cost included cost of building and cost of equipment. To calculate the cost of building and cost of equipment, depreciation had to estimate to transfer cost of building and cost of equipment to the present value. In Thai Nguyen General Hospital, almost equipments are new; therefore the present value of those equipments was similar with original price. However, buildings in Thai Nguyen General Hospital were built many years ago (almost more than 50 years) and also some of building in Thai Nguyen General Hospital did not have original price and year of build, therefore after depreciation, present value of those building were very small when compare with original price.

From table 5.21 we can also see that, material cost had the lowest percentage which was 22%. When calculate material cost, there was no depreciation cost has to estimate because materials were used within one year.

Full cost of patient service centers in Thai Nguyen General Hospital

The result in table 5.26 shows that the total full cost of patient service centers was USD 2,373,049. In which, total cost of clinics, intensive care, orthopedic, anesthetic, pediatric, obstetric and oncology were higher than other PS, those cost were USD 144,824 for clinics; USD 323,500 for intensive care; USD 109,294 for

orthopedic; USD 327,099 for anesthetic; USD 193,744 for pediatric; USD 131,701 for obstetric and USD 115,868 for oncology.

Total full cost of gastroenterology which include urology department in 2011 was USD 65,407. In which total cost of urology department was USD 20,455, took 31% of total cost of gastroenterology.

Unit cost of inpatient services at urology department in Thai Nguyen General Hospital

The unit cost of inpatient service at urology department was USD 3.4 per inpatient day per patient. The gap between the unit cost of inpatient service at urology department and the partial user-fee for one inpatient service was 2.93. The unit cost of inpatient service at urology department was 7.23 times higher than the partial user-fee for one inpatient service. This is the burden cost which hospital has to suffer. Hospitals now are trying to by longer useful life, high quality and high technology equipments and also they are trying to hire a good quality staffs. Government has subsidized hospital but just base on number of hospital beds to allocate resource, therefore it not reflect the reality. Government should base on quality services or quality activities of hospital to allocate resource.

6.2 Limitation of study

The research on “The analysis of unit cost of in-patient services at urology department in Thai Nguyen General Hospital in Vietnam” was carried out on 21/3/2012 and finished on 2/4/2012. This research shows the specific burden cost which hospital had to bear, and it is not only provide a good evidence for hospital management in resources management, but also provides a good and actual evidence

for policy maker in reform health policy and resources allocation. However, this study still has some limitation during data collection period, data analysis.

Because urology department just only has inpatient services, the outpatient service was not included in research. In data collection period, there was missing data in this study: some equipments and building of cost centers had no data about original price, year of purchasing, and some equipments was purchased more than 20 years ago, they are out of date, some of building of cost centers were built more than 50 years ago, and they didn't have data about original price and year of build, but those data is not much, therefore the reliability of this research can be accepted.

This research based on provider perspective, therefore the cost burden comes from patient perspective could not be covered. To providing a clear evidence for improving healthcare quality, it necessary to has more studies on patient perspective.

6.3 Suggestion and Policy implications

Because this study just focus in one year data, show there will have a need for more research on related topic through years. When doing that, comparison hospital cost through every year will be easier and it will provide a good evidence for hospital management and health policy maker.

Our opinion comes from research result is policy maker should be consider about health resources allocation and health policy. It will not only improve quality of healthcare service and also improve the constancy of society economic.

Because of the scarcity of the resource, policy make can use the allocation criteria to improve or upgrade budget allocation factor by finding and using the appropriate unit of measurement to allocate budget in over the hospitals of Vietnam,

such as using number of staffs working in the hospitals, output of hospitals or activity of hospital, and productivity of hospitals.

To reduce the gap between the unit of inpatient service at urology department and the partial user-fee for one inpatient service, hospital can reduce the capital cost by use more equipments which have longer useful life instead equipments have shorter useful life. At the present, hospitals are buying new equipments which is high quality, high technology and longer useful life. And also, hospitals are trying to keep and hire good health staffs rather have so many health staffs but not well at quality of work, therefore, hospital can reduce labor cost.

From many years, Government has based on number of bed to distribute resource to Thai Nguyen General Hospital and other hospitals (Ministry of Health Vietnam, 2008). Because Thai Nguyen General Hospital is level I hospital and also is one of the largest health center in Northern Vietnam, a lot of patients come to this hospital. This hospital is always in overload situation, there are five or more than five patients in one bed. If government just bases on number of hospital beds to distribute resources, it will not reflect the reality. And also, government should focus on quality of hospital to allocate resource; this will be the motivation for hospitals to improve their capacity as well as their quality.

Hospital should readjusted or redeveloped the information system which can be used in routine operation in the hospital, the data of building, equipment and labor should have well record in the computer system, these information will be useful and more accurate for resource allocation, financial planning, decision making and management hospital.

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APPENDICES

Appendix 1: Fee Schedule Decree No.14 TT/LB**Part A:****PRICE FRAME FOR EXAMINATION AND HEALTH CHECKING**

(Units: VND)

No	Content	Level 1 Hospital	Level 2 Hospital	Level 3 Hospital	Level 4 Hospital and Clinic
1	General clinical examination; Specialistic examination	2.000-3.000	1.500-3.000	1.000-2.000	500-1.000
2	Examination according to requirements (selecting Physician)	10.000-30.000	10.000-20.000	10.000-20.000	
3	Examination, issuing injured certificate, Medical examination (excluding laboratory tests, X-ray)	15.000-35.000	15.000-30.000	10.000-20.000	
4	Fully health examination for recruiting worker, driver (excluding laboratory tests, X-ray)	25.000-50.000	25.000-40.000	18.000-35.000	

Part B:**PRICE FRAME FOR A BED DAY**

(Calculating Unit: 1000 VND)

Type of bed according the departments	Level 1 Hospital	Level 2 Hospital	Level 3 Hospital	Level 4 Hospital
A bed day for Emergency resuscitation, day of birth and 2 days after birth	12 - 18	8 - 12	6 - 9	3 - 6
Cost per bed day for internal medicine				

Type 1	The Faculties of Infectious Diseases, Respiratory, Hematology, Oncology, Cardiology, Neurology, Pediatrics, Peptics, Nephrology, from the 3th day after birth, day of surgical treatment after the 11 th day of surgery,	8 - 10	6 - 8	3 - 5	2 - 3
Type 2	The Faculties of Rheumatology, dermatology, Allergy , ENT, ophthalmic, Odontostomatology, Surgery, Obstetric without operation.	6 - 8	4 - 6	2 - 5	1,5 - 2,5
Type 3	The Faculties: Traditional medicine, rehabilitation	4 - 6	2,5 - 4	1,5 - 3	1 - 1,5
Cost per bed day for Surgery; Burn					
Type 1	After special surgeries Burn level 3-4 above 70%	15-20	10-16	-	-
Type 2	After surgeries of type 1 Burn level 3-4 from 25% - 70%	10-15	6-10	5-10	-
Type 3	After surgeries of type 2 Burn level 2 above 30%, Burn level 3-4 below 25%	8-10	5-8	4-7	-
Type 4	After surgeries type 3 Burn level 1, level 2 below 30%	6-8	4-6	3-5	2-3

MAXIMUM PRICE FOR A DAY OF IN-PATIENT TREATMENT

(Unit: Dong)

No	Inpatient day	Price for a day of treatment			
		Level 1 Hospital	Level 2 Hospital	Level 3 Hospital	Level 4 Hospital
1	An inpatient day of treatment for Emergency intensive care	120.000	86.000	30.000	20.000
2	An inpatient day of treatment for internal medicine				

2.1.	Blood disease and cancer	50.000	50.000	-	-
2.2.	Pediatric, infectious, respiration, cardiovascular, gastroenterology, ENT, odonto – stomatology, Neurology, Psychiatry, dermatology, obstetric,	40.000	40.000	20.000	10.000
2.3	Traditional medicine, Rehabilitation	30.000	20.000	15.000	10.000

2. Consumer index price through years

Year	CPI
1973	70,4
1974	71,6
1975	72,8
1976	74,0
1977	75,2
1978	76,4
1979	77,6
1980	78,8
1981	80,0
1982	81,2
1983	82,4
1984	83,6
1985	84,8
1986	86,0
1987	87,2
1988	88,4
1989	89,6
1990	90,8
1991	92,0
1992	93,2
1993	94,4
1994	95,6
1995	96,8
1996	98,0
1997	99,2
1998	100,0
1999	102,0
2000	103,0
2001	104,0

2002	105,0
2003	108,2
2004	116,6
2005	126,2
2006	135,9
2007	147,4
2008	104,9
2009	141,0
2010	118,1
2011	100,5

Source: Vietnam Ministry of finance

3. Sensitivity analysis

Change curtain year of equipment to seven years instead five years

Capital cost of equipment of trade union when change curtain life year of equipment to seven years instead five years

1US\$ = VND 21036

Cost center	Equipment	Original price	Year: first use	IAF	Replacement cost	Useful life (n)	Annuity Factor	capital cost of equipment in 2009
Trade union	Computer	17	2010	0.8510	14	7	6.23	2
	Computer	461	2010	0.8510	392	7	6.23	63
	Printer	218	2010	0.8510	186	7	6.23	30
	Computer	474	2011	1.0000	474	7	6.23	76
	Printer	160	2011	1.0000	160	7	6.23	26
	UPS							
	500VA	56	2011	1.0000	56	7	6.23	9
	Table	38	2011	1.0000	38	7	6.23	6
	Chair	28	2011	1.0000	28	7	6.23	4
	Lioa	6	2011	1.0000	6	7	6.23	1
	Total	1.458			1.354			217

Capital cost of cost centers when change curtain life year of equipment to seven years instead five year

Cost center	Code	Capital cost	Direct cost
Trade union office	NRPCC1	665	850
Rector board	NRPCC2	1.318	17.291
General planning	NRPCC3	421	32.901
Personnel	NRPCC4	4	47.613
Finance	NRPCC5	1.066	47.180
Administration	NRPCC6	2.331	73.658
Supply	NRPCC7	6.874	38.198
Nursing	NRPCC8	170	15.120
Direction of healthcare activities	NRPCC9	289	5.871
Nutrition	NRPCC10	488	8.851
Infectious control	NRPCC11	30.484	85.880
Hematology	RPCC1	26.596	222.728
Biochemistry	RPCC2	34.576	220.934
Microbiology	RPCC3	4.844	20.972
Radiology	RPCC4	196.635	337.083
Pathology	RPCC5	12.231	34.518
Pharmacy	RPCC6	1.752	46.108

Function exploration	RPCC7	52.754	100.212
Clinics	PS1	18.555	125.184
Intensive care	PS2	85.147	286.391
Cardiovascular internal	PS3	3.892	52.537
Internal 4	PS4	1.543	31.335
Neurology	PS5	3.415	43.350
Psychiatry	PS6	581	31.416
Orthopedic	PS7	6.031	88.315
Anesthetic	PS8	140.561	280.706
General surgery	PS9	2.339	59.041
Ophthalmology	PS10	25.695	67.278
ENT	PS11	9.669	39.029
Odonto - stomatology	PS12	14.716	60.508
Pediatric	PS13	39.751	159.787
Obstetric	PS14	10.070	97.426
Infectious	PS15	3.720	37.174
Rehabilitation	PS16	26.680	67.755
Traditional medicine	PS17	3.439	25.831
Oncology	PS18	39.981	97.098
Nuclear medicine	PS19	8.592	37.814
Respiration internal	PS20	9.704	54.957
Gastroenterology	PS21	2.246	48.626
Dermatology	PS22	1.815	26.039
Digestive surgical	PS23	286	60.771
Cardiovascular surgery	PS24	26.043	43.942

Stepdown method allocation when change curtain life of equipment to seven years instead five years

Cost center	Code	Total direct cost	First allocation	Second allocation	Third allocation	Fourth allocation	Fifth allocation	Sixth allocation	Seventh allocation	Eighth allocation	Ninth allocation	Tenth allocation	Eleventh allocation	Twelfth allocation
Trade union office	NRPCC1	850	0	0	0	0	0	0	0	0	0	0	0	0
Rector board	NRPCC2	17.291	17.295	0	0	0	0	0	0	0	0	0	0	0
General planning	NRPCC3	32.901	32.918	33283,9544	0	0	0	0	0	0	0	0	0	0
Personnel	NRPCC4	47.613	47.636	48115,7478	49059,0177	0	0	0	0	0	0	0	0	0
Finance	NRPCC5	47.180	47.203	47659,6946	48558,047	49920,7975	0	0	0	0	0	0	0	0
Administration	NRPCC6	73.658	73.695	74448,9139	75931,1953	78179,7336	80.533	0	0	0	0	0	0	0
Supply	NRPCC7	38.198	38.212	38486,0516	39025,063	39842,7133	40.698	42.147	0	0	0	0	0	0
Nursing	NRPCC8	15.120	15.125	15239,3965	15463,9846	15804,6722	16.161	16.765	16.775	0	0	0	0	0
Direction of healthcare activities	NRPCC9	5.871	5.874	5942,45075	6077,2036	6281,61618	6.496	6.858	6.870	6.870	0	0	0	0
Nutrition	NRPCC10	8.851	8.855	8923,33258	9058,08543	9262,49801	9.476	9.839	9.860	9.860	9.860	0	0	0
Infectious control	NRPCC11	85.880	85.907	86455,3501	87533,373	89168,6735	90.880	93.778	95.212	95.212	95.212	95.579	0	0
Hematology	RPCC1	222.728	222.754	223302,793	224380,816	226016,116	227.728	230.625	231.958	231.958	231.958	232.326	232.326	232.326
Biochemistry	RPCC2	220.934	220.947	221197,949	221692,043	222441,556	223.226	224.554	226.331	226.331	226.331	226.499	226.499	226.499
Microbiology	RPCC3	20.972	20.980	21140,2155	21454,6389	21931,6015	22.431	23.276	23.524	23.524	23.524	23.631	23.631	23.631
Radiology	RPCC4	337.083	337.108	337610,503	338598,691	340097,716	341.667	344.323	354.164	354.164	354.164	354.501	354.501	354.501
Pathology	RPCC5	34.518	34.526	34685,5809	35000,0042	35476,9669	35.976	36.821	37.434	37.434	37.434	37.541	37.541	37.541
Pharmacy	RPCC6	46.108	46.131	46610,823	47554,093	48984,981	50.483	53.018	53.096	53.096	53.096	53.417	53.417	0
Function exploration	RPCC7	100.212	100.234	100691,161	101589,513	102952,264	104.379	106.793	109.484	109.484	109.484	109.791	109.791	109.791
Clinics	PS1	125.184	125.238	126334,335	128490,38	131760,981	135.184	140.980	141.804	142.002	142.083	142.818	143.946	144.147
Intensive care	PS2	286.391	286.432	287277,75	288939,702	291460,79	294.099	298.567	302.872	303.569	303.855	304.421	308.395	314.130
Cardiovascular internal	PS3	52.537	52.566	53160,3676	54328,2257	56099,8013	57.954	61.093	61.283	62.219	62.603	63.001	68.337	71.112
Internal 4	PS4	31.335	31.348	31622,2932	32161,3046	32978,9549	33.835	35.284	35.362	35.698	35.836	36.019	37.935	39.338

Neurology	PS5	43.350	43.371	43804,9527	44658,3874	45953,0004	47.308	49.602	49.749	50.351	50.598	50.889	54.318	56.176
Psychiatry	PS6	31.416	31.430	31703,7193	32242,7307	33060,381	33.916	35.365	35.391	35.675	35.791	35.975	37.590	38.733
Orthopedic	PS7	88.315	88.353	89129,5884	90656,7874	92973,4632	95.398	99.503	99.785	100.945	101.421	101.941	108.554	111.966
Anesthetic	PS8	280.706	280.735	281328,587	282496,445	284268,021	286.122	289.261	296.577	296.652	296.683	297.081	297.507	297.681
General surgery	PS9	59.078	59.105	59653,0348	60731,0576	62366,3582	64.078	66.976	67.090	68.282	68.770	69.138	75.931	79.033
Ophthalmology	PS10	67.278	67.298	67709,0992	68517,6163	69744,0918	71.028	73.201	74.467	74.752	74.868	75.144	76.764	77.726
ENT	PS11	39.029	39.044	39340,9485	39924,8775	40810,6654	41.738	43.307	43.737	44.286	44.510	44.709	47.836	49.648
Odonto - stomatology	PS12	60.508	60.529	60963,2925	61816,7272	63111,3401	64.466	66.760	67.489	67.818	67.952	68.243	70.117	71.262
Pediatric	PS13	159.787	159.823	160554,115	161991,478	164171,879	166.454	170.318	172.349	174.188	174.941	175.431	185.909	190.120
Obstetric	PS14	97.426	97.462	98192,6589	99630,0226	101810,423	104.093	107.956	108.426	111.435	112.667	113.157	130.302	135.457
Infectious	PS15	37.174	37.187	37461,5012	38000,5126	38818,1629	39.674	41.123	41.286	41.851	42.082	42.266	45.485	47.215
Rehabilitation	PS16	67.755	67.774	68162,6089	68926,2083	70084,5463	71.297	73.349	74.676	75.100	75.273	75.533	77.948	81.450
Traditional medicince	PS17	25.831	25.842	26070,5651	26519,7413	27201,1165	27.914	29.122	29.273	29.576	29.701	29.854	31.583	32.931
Oncology	PS18	97.098	97.129	97768,5869	99026,2802	100934,131	102.931	106.312	108.041	109.023	109.425	109.854	115.450	119.942
Nuclear medicine	PS19	37.814	37.829	38125,5659	38709,495	39595,2828	40.522	42.092	42.518	42.776	42.881	43.080	44.549	45.359
Respiration internal	PS20	54.957	54.980	55459,8861	56403,1561	57834,0441	59.332	61.867	62.373	63.078	63.367	63.689	67.710	69.810
Gastroenterology (include urology)	PS21	48.626	48.650	49129,6113	50072,8812	51503,7692	53.001	55.537	55.655	56.515	56.868	57.189	62.090	64.731
Dermatology	PS22	26.039	26.051	26302,6405	26796,7343	27546,2471	28.331	29.659	29.739	30.131	30.292	30.460	32.693	33.842
Digestive surgical	PS23	60.771	60.788	61130,8134	61804,5777	62826,6405	63.896	65.707	65.724	66.293	66.527	66.756	70.001	71.764
Cardiovascular surgery	PS24	43.942	43.951	44133,7576	44493,0985	45038,1987	45.609	46.575	47.941	48.166	48.258	48.380	49.660	50.451

Full cost of gastroenterology was US\$ 64731,

Cost of urology department = 31% x US\$ 64731 = \$20067

Unit cost of inpatient service at urology department = \$20067/6016=\$3

Rate between unit cost of inpatient service at urology department = \$3/\$0.47=6.3

Allocate cost of Para-clinic centers to PS

Step down allocation when allocate cost of Para-clinic centers to PS

Cost center	Code	Total direct cost	Cost allocation of hematology	Cost allocation of biochemistry	Cost allocation of microbiology	Cost allocation of radiology	Cost allocation of pathology	Cost allocation of function exploration
Trade union office	NRPCC1	928	0	0	0	0	0	0
Rector board	NRPCC2	17.291	0	0	0	0	0	0
General planning	NRPCC3	32.919	0	0	0	0	0	0
Personnel	NRPCC4	47.613	0	0	0	0	0	0
Finance	NRPCC5	47.329	0	0	0	0	0	0
Administration	NRPCC6	73.862	0	0	0	0	0	0
Supply	NRPCC7	38.219	0	0	0	0	0	0
Nursing	NRPCC8	15.192	0	0	0	0	0	0
Direction of healthcare activities	NRPCC9	5.871	0	0	0	0	0	0
Nutrition	NRPCC10	8.851	0	0	0	0	0	0
Infectious control	NRPCC11	88.733	0	0	0	0	0	0
Hematology	RPCC1	227.126	0	0	0	0	0	0
Biochemistry	RPCC2	227.667	233.240	0	0	0	0	0
Microbiology	RPCC3	21.890	24.553	24.553	0	0	0	0
Radiology	RPCC4	369.291	386.731	386.731	386.731	0	0	0
Pathology	RPCC5	36.539	39.568	39.568	39.568	39.568	0	0
Pharmacy	RPCC6	46.156	0	0	0	0	0	0
Function exploration	RPCC7	110.033	119.627	119.627	119.627	119.627	119.627	0
Clinics	PS1	125.793	145.716	146.596	146.688	148.146	148.295	148.746
Intensive care	PS2	301.346	354.659	379.701	382.337	423.859	428.107	440.951
Cardiovascular internal	PS3	53.049	84.113	96.234	97.510	117.607	119.663	125.880
Internal 4	PS4	31.605	45.897	52.025	52.670	62.831	63.870	67.013
Neurology	PS5	43.358	64.539	72.650	73.504	86.953	88.329	92.489
Psychiatry	PS6	31.446	43.890	48.882	49.407	57.684	58.531	61.091
Orthopedic	PS7	88.827	127.830	142.726	144.295	168.995	171.522	179.162
Anesthetic	PS8	310.263	328.048	328.810	328.891	330.155	330.284	330.675
General surgery	PS9	59.359	93.294	106.840	108.267	130.728	133.027	139.975
Ophthalmology	PS10	71.024	85.798	89.998	90.440	97.403	98.115	100.269
ENT	PS11	39.345	58.103	66.016	66.849	79.969	81.311	85.370

Odonto - stomatology	PS12	62.734	78.640	83.643	84.170	92.466	93.314	95.881
Pediatric	PS13	167.276	216.621	235.006	236.942	267.426	270.545	279.975
Obstetric	PS14	98.274	159.708	182.216	184.586	221.906	225.725	237.269
Infectious	PS15	37.245	55.061	62.613	63.409	75.931	77.213	81.086
Rehabilitation	PS16	71.914	101.220	116.511	118.120	143.473	146.067	153.910
Traditional medicince	PS17	25.910	39.049	44.937	45.557	55.320	56.318	59.338
Oncology	PS18	97.323	140.274	159.888	161.953	194.475	197.802	207.862
Nuclear medicine	PS19	39.129	50.317	53.853	54.225	60.087	60.687	62.500
Respiration internal	PS20	57.006	81.311	90.483	91.449	106.657	108.213	112.917
Gastroenterology (include urology)	PS21	49.134	77.111	88.642	89.856	108.976	110.932	116.846
Dermatology	PS22	26.093	39.065	44.082	44.610	52.928	53.779	56.352
Digestive surgical	PS23	60.868	79.786	87.484	88.294	101.058	102.364	106.312
Cardiovascular surgery	PS24	49.681	59.741	63.193	63.557	69.281	69.867	71.638

Full cost of gastroenterology was US\$ 116846,

Cost of urology department = 31% x US\$ 116846 = \$36222

Unit cost of inpatient service at urology department = \$36222/6016=\$6.02

Rate between unit cost of inpatient service at urology department = \$6.02/\$0.47=1

BIOGRAPHY

Name : Hoang Thi Van Anh

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Back ground: Bachelor of Public Health
Hanoi Medical University

Nationality: Vietnam

Work experiences Project technical assistant

