

**COSTING OF CLINICAL SERVICES AND COST DETERMINANTS AT PUBLIC  
DISTRICT HEALTH FACILITIES IN FOUR PROVINCES OF VIETNAM**

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ต้นทุนค่าบริการทางคลินิกและปัจจัยต้นทุนของสถานบริการสุขภาพของรัฐในสี่จังหวัดของเวียดนาม



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By	Mrs. Do Tra My
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Thesis Advisor	Assistant Professor Chantal Herberholz, Ph.D.

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คู่มือ : ต้นทุนค่าบริการทางคลินิกและปัจจัยต้นทุนของสถานบริการสุขภาพของรัฐในสี่จังหวัดของเวียดนาม (COSTING OF CLINICAL SERVICES AND COST DETERMINANTS AT PUBLIC DISTRICT HEALTH FACILITIES IN FOUR PROVINCES OF VIETNAM) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร. ชันทาล แฮร์เบอร์โฮลส์, หน้า.

การศึกษานี้มีเป้าหมายเพื่อคำนวณต้นทุนของการให้บริการผู้ป่วยนอกและผู้ป่วยในของเขตบริการสุขภาพจำนวน 33 แห่ง ในประเทศเวียดนามโดยมีรูปแบบการจ่ายเงินที่แตกต่างกัน 2 รูปแบบและต้องการค้นหาปัจจัยที่มีผลต่อการคำนวณต้นทุน โดยวิธีการคิดต้นทุนใช้วิธีการทบทวนข้อมูลย้อนหลังของปีปฏิทิน ค.ศ.2014 ที่ทำการเก็บข้อมูลโดย สถาบันยุทธศาสตร์และนโยบายทางการแพทย์ ประเทศเวียดนาม

การคำนวณต้นทุนด้วยวิธีการ Top-down และการกระจายต้นทุนแบบ Step down ถูกใช้ในการคำนวณต้นทุนต่อหน่วยในมุมมองของผู้ให้บริการ เพื่อค้นหาปัจจัยต้นทุน ร่วมกับการวิเคราะห์สมการถดถอยเชิงเส้นแบบ OLS โดยเฉลี่ยค่าใช้จ่ายต่อการเข้ารับการรักษาผู้ป่วยนอกเตียงผู้ป่วยในและการจำหน่ายในแต่ละจังหวัดมีค่าตั้งแต่ 73,000 VND (US\$ 3.45) ถึง 133,000 VND (US\$ 6.29), 233,000 VND (US\$ 11.04) ถึง 282,000 VND (US\$ 13.34) ) และ 1,097,000 VND (US\$ 51.90) เป็น 1,487,105 VND (US\$70.21) ตามลำดับ โดยเฉลี่ยค่าแรง: วัสดุ: ต้นทุนทุนของ 4 จังหวัดเท่ากับ 41: 46: 13 ค่าใช้จ่ายในการเข้ารับการรักษาผู้ป่วยนอกและวันผู้ป่วยในแต่ละจังหวัดมีค่าสูงกว่าราคาค่าบริการที่ปรับล่าสุดที่ซึ่งผลในเดือนมิถุนายน 2560 สมการถดถอยเชิงเส้นแสดงให้เห็นว่า สำหรับการจำหน่ายผู้ป่วย การเพิ่มขึ้นของอัตราครองเตียงส่งผลต่อการลดลงของต้นทุนในขณะที่การเพิ่มขึ้นของจำนวนวันนอนส่งผลต่อการเพิ่มขึ้นของต้นทุน ในส่วนของจำนวนวันนอน การเพิ่มขึ้นของอัตราการครองเตียงเกี่ยวพันกับการลดลงของต้นทุนต่อหน่วยวันนอน ส่วนตัวแปรแทนไม่รูปแบบการจ่ายเงินมีผลต่อต้นทุน หรืออีกนัยหนึ่งคือไม่มีความแตกต่างของต้นทุนของการให้บริการผู้ป่วยในสำหรับรูปแบบการจ่ายเงินที่แตกต่างกัน

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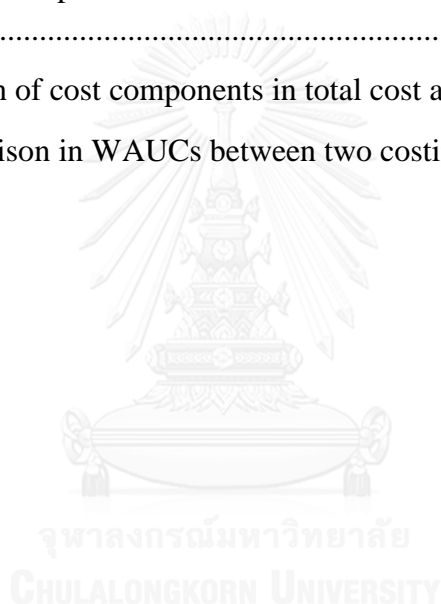
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## LIST OF ABBREVIATION

ALOS	Average length-of-stay
BOR	Bed occupancy rate
CBA	Cost benefit analysis
CEA	Cost effectiveness analysis
CHC	City health center
CHS	Commune health station
DH	District hospital
DHC	District health center
DOH	Department of Health
DRG	Diagnosis related group
FFS	Fee-for-service
GDP	Gross Domestic Product
HI	Health insurance
HSPI	Health Strategy and Policy Institute
IP	Inpatient
IPD	Inpatient department
JLN	Joint Learning Network
MOH	Ministry of Health
NGO	Non-Government Organization
ODA	Official development assistance
OLS	Ordinary least squares
OP	Outpatient
OPD	Outpatient department
PPM	Provider payment mechanism
SHI	Social Health Insurance
THE	Total Health Expenditure
UHC	Universal Health Coverage
VSS	Vietnam Social Security
WAUC	Weighted average unit cost
WHO	World Health Organization

## CHAPTER 1

### INTRODUCTION

#### 1.1. Motivation

Achieving the Universal Health Coverage (UHC) is one of the top priorities on the health agenda of many countries in the world. As a key point for reaching the UHC, a well-designed provider payment system is particularly critical to enable the most value for the limited resources, good quality of care, timely provision of services, and being fit for health policy priority. Besides choosing payment mechanism, the payment rate is a critical decision in provider payment policies for the purpose of creating the right incentives to providers (Aboagye, Degboe, & Obuobi, 2010; Mogyorosy & Smith, 2005; Özaltın et al., 2014; Shepard, Hodgkin, & Anthony, 1998).

In Vietnam, regarding the health insurance law which has been approved by National Assembly in 2008 and took into effect on 1st of July 2009, fee-for-service (FFS) and capitation are two main types of provider payment which has been applying to health facilities. However, none of the methods is currently reflecting the cost of providing health care services in Vietnam.

For FFS, fee schedule first was estimated by selected central hospital, and then was adjusted by experts instead in using of costing exercise. After four updated times during almost 30 years of implementation, the latest fee schedule which took effect in June 2017 was estimated on the cost basis of four out a total seven input cost components of each service including (i) Medicine, blood, intravenous fluids, chemicals, consumable materials; (ii) utilities such as water, electricity, and fuel; (iii) maintenance of medical equipment and (iv) salaries, allowances and other contributions.

For capitation, it was applied first to mainly district level facilities in 2004 for both of outpatient and inpatient services, and it has many shortcomings related to both of designing and implementing (Health Strategy and Policy Institute, 2013). Therefore, in 2014, Bac Ninh, Ninh Binh, Thua Thien Hue and Khanh Hoa provinces were chosen for implementing the pilot “new” capitation according to Decision No. 5380/QD-BYT on December 30, 2013 (Ministry of Health, 2013a). In this project, two models were applied (Ministry of Health, 2013b): (i) Capitation for outpatient services with exclusion of some high tech, high cost services and referral payment, FFS for inpatient services at Bac Ninh and Ninh Binh province; (ii) capitation for outpatient and inpatient services with exclusion of referral payment and some high tech and high cost services at Thua Thien Hue and Khanh Hoa province. However, in the process of designing this project, the technical group found out some problems remains unresolved, mainly related to the calculation of base rate and total capitation fund as well. Due to missing data on the actual cost of service provision, all formulas for calculation the capitation fund for both of two models were still based on the historical expenditure (Vietnam Ministry of Health, 2015). Hence, one of the important activities which have been mentioned in the pilot project is to apply the toolkit from the Joint Learning Network (JLN) for Universal Health Coverage in conducting a costing exercise of clinical services at district facilities implementing the pilot capitation project<sup>1</sup>. This toolkit has been used for the first time in the study by Van Minh et al. (2015) for estimating the unit costs of primary care visits (OP visits) at 76 commune health stations (CHSs) in Hai Duong and Thai Nguyen province (Minh, Phuong, Özaltın, & Cashin, 2015).

Information on hospital costs is valuable to not only decision-makers but also hospital managers in resources allocation and running hospital. In

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<sup>1</sup> JLN has been supporting some developing countries in conducting costing exercises, including Vietnam. HSPI is one of the members in costing group (Özaltın et al., 2014)

Vietnam, Hospital financial autonomy policy came into effect in 2002, giving hospital managers more authority and responsibility to use state budget as well as mobilize resources from society (The Government of Vietnam, 2002). They face considerable pressure to curb the pace of cost increases while ensuring the quality of healthcare services to the patient at an acceptable level. The question is larger health facilities are more or less efficient than the others. A few studies showed that factors such as the type of health facilities, average length of stay, bed occupancy rate, drug cost contribute significantly to the difference in the unit cost of inpatient services (Adam, Evans, & Murray, 2003; Anderson, 1980). Hospital managers, therefore need to understand the actual cost and cost determinants of the services they provide for the purpose of assessing the efficiency of their hospitals (Mogyorosy & Smith, 2005; Özaltın et al., 2014; Shepard et al., 1998).

Some studies on costing have been implemented in Vietnam for 15 years, focus on either basic medical services or a particular disease (e.g., diabetes) in view of provider perspective (Chuc & Phuong, 2002). These costing studies provided policy-makers with a simple picture of health service costs to inform policy discussions. However, authors also emphasized this be only preliminary results on a small scale. The calculation of payment rates for reforming the PPMs will be more realistic with the comprehensive and detail data (Minh et al., 2015). Hence it is necessary to add more primary health facilities for a larger and more representative sample in the next phase of the costing study. Moreover, there is no study has been conducted to examine the factors affecting to unit costs of delivering the health services.

In this study, the unit costs of all outpatient services and inpatient services at 33 district public health facilities in four pilot provinces will be estimated, including (i) cost per outpatient visit; (ii) cost per inpatient bed-day and (iii) cost per discharge. Results from this study are intended to provide database as a starting point for calculating the base rate and total capitation



fund in the process of applying capitation model in the coming years. Besides, the unit cost of outpatient services and inpatient services will be compared with the new fee schedule to examine any differences. Finally, this study is also going to apply the ordinary least squares regression models to identify the influential factors to unit costs.

## **1.2. Research Question**

- 1) What are unit costs of outpatient and inpatient services from the perspective of the provider at 33 district public health facilities?
- 2) Which are factors affecting to the unit cost of outpatient services and inpatient services?

## **1.3. Objective**

### **1.3.1. General objective**

The objective of this study is to calculate the costs of outpatient and inpatient services from the provider perspective at 33 district public health facilities in four provinces in the calendar year 2014.

### **1.3.2. Specific objective**

- 1) To calculate the unit cost of outpatient visit; inpatient bed-day and discharge at each district public health facilities in four provinces in the calendar year 2014.
- 2) To determine the contribution of different cost components (Labor cost: Material cost: capital cost) in total costs of study health facilities in four provinces in the calendar year 2014.
- 3) To calculate the difference between the cost per outpatient visit and inpatient bed-day and the new fee schedule that took effect in June 2017.

- 4) To explore possible determinants of the cost per outpatient visit; inpatient bed-day and discharge at 33 district public health facilities in four provinces in the calendar year 2014.

#### **1.4. Hypotheses**

The hypotheses in this study were formulated from the literature review. Firstly, almost all studies revealed that the largest share of the total cost was labour cost, followed by material cost (Chatterjee, Levin, & Laxminarayan, 2013; Chuc & Phuong, 2002; Hammad, Fardous, & Abbadi, 2016; Minh et al., 2010; Minh et al., 2015; Olukoga, 2007; Prinja et al., 2016; Younis, Jaber, Mawson, & Hartmann, 2013). Secondly, some studies indicated the user fee charge at health facilities was below the actual cost of providing health services many times (Chuc & Phuong, 2002; Minh et al., 2010). Finally, studies by Anderson (1980) and Adam et al. (2003) explored some factors influencing the unit cost of inpatient services. An increase in occupancy rate results in a reduction in the unit cost whereas an additional day of hospital stay and a growth of drug cost results in an increase in the unit cost (Adam et al., 2003; Anderson, 1980). As a result, there are four hypotheses in this study, including:

- 1) The labor cost account for the highest share of the total cost.
- 2) The actual unit cost of outpatient and inpatient services is higher than the fee schedule.
- 3) An increase in drug cost and the average length of stay is associated with an increase in the unit cost of inpatient services.
- 4) An increase in bed occupancy rate is associated with a reduction in the unit cost of inpatient services.

### **1.5. Scope of the the study**

This study uses the secondary data<sup>2</sup> which collected at all district public health facilities (hospitals or health centres) in Bac Ninh, Ninh Binh, Thua Thien Hue and Khanh Hoa. Totally, 33 district public health facilities will involve in the study as follows: (i) Bac Ninh province: seven district hospitals and one city health center; (ii) Ninh Binh province: five district hospitals and one city health center; (iii) Thua Thien Hue province: eight district health centers and one city health center; and (iv) Khanh Hoa province: six district health centers and two city health center. The data were collected from January 2014 to December 2014.

### **1.6. Possible benefit**

Information on the actual cost of health services is valuable to health decision-makers in hospital payment reforms in Vietnam. First, the results will be used as one of the inputs to set payment rates which help to create the right incentives to providers as well as to improve financial protection for patients. Second, estimation the gap between the unit cost of outpatient services and inpatients services and the fee schedule will provide better information for policymakers in developing accurate and adequate hospital fee schedule in the coming years. Besides, this costing study also provides useful information for hospital managers in financial management. By understanding their hospitals' cost structure, the managers can balance the gap between available resource and requirements to run health facilities more efficient.

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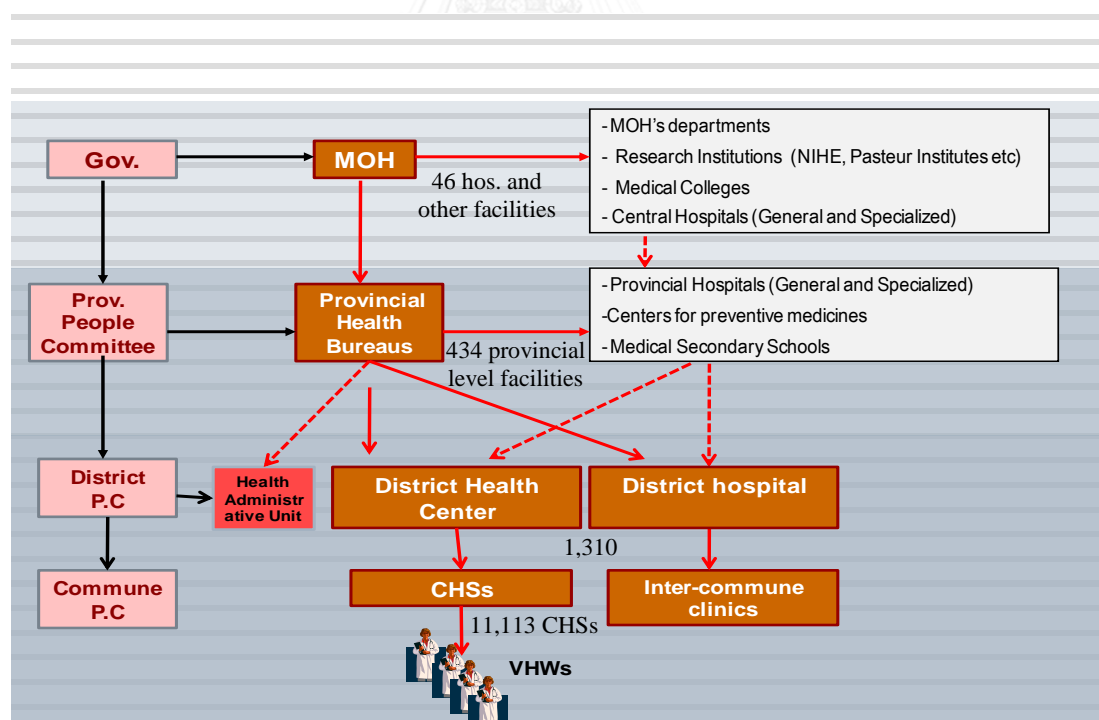
<sup>2</sup> I have responsibility for collecting and verifying data in Thua Thien Hue province

## CHAPTER 2

### BACKGROUND INFORMATION

#### 2.1. Health care delivery

Healthcare in Vietnam is organized according to a three-level system including central, provincial and primary levels (Figure 1). At the central level, there are 46 hospitals and other inpatient facilities under the management of the Ministry of Health (MOH). At the provincial level, 63 provincial departments of health (DOH) are managing the local health systems with 434 provincial level facilities. At the primary level, there are 1,310 district hospitals/health centres and 11,113 commune health stations (CHSs) that provide primary health care (General Statistics Office of Vietnam, 2015).



**Figure 1: The administrative structure of the health care system in Vietnam (2011)**

*Source: Health Strategy and Policy Institute*

The most common issue facing the service delivery system's organization is an excessive patient load at the provincial and central levels. Although the overload at the higher level is well recognized, people continue to bypass health services at lower levels that are 'under-loaded'. Several reasons are explaining why patients might choose to access higher levels of care directly. First is the absence of specialties and equipment at the lower levels. Besides, patients are free to choose which level of care they want to access health services. Finally, for insured patients who bypassed, health insurance reimbursement is still made with higher copayment rate (Health Strategy and Policy Institute, 2011).

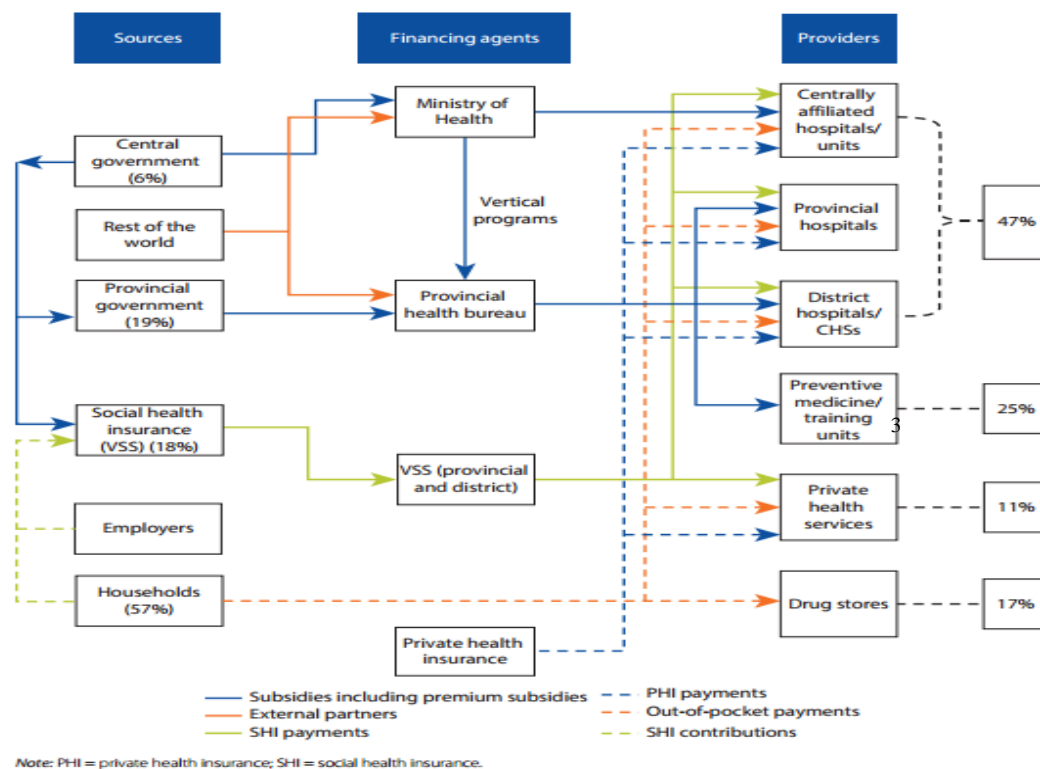
Moreover, the current organizational structure of district level is not consistent among localities. Before 2008, according to Decree No. 172/2004/ND-CP (The Government of Vietnam, 2004) and Circular No. 11/2005/TTLT-BYT-BNV (Vietnam Ministry of Health, 2005b), the primary health care system comprised of district hospital, preventive health centre and CHSs. District hospital and preventive health centre were managed directly by the Department of Health while CHSs were managed under District Department of health. District preventive health centres had the function of implementing the technical and professional tasks related to prevention and control of HIV/AIDS and social disease, food safety, reproductive care, communication and health education. District hospitals had responsibility for checking up and treatment of patients with common diseases or in emergency cases at the grassroots level. However, since 2008, Decree No.14/2008/ND-CP (The Government of Vietnam, 2008) and Circular 03/2008/TTLT-BYT-BNV (Vietnam Ministry of Health, 2008b) has been issued to replace the old one. Accordingly, the organization model has changed when the preventive health centre formerly is converted into a health centre. For localities where do not have enough condition to establish a hospital, the health centre will perform both functions of prevention and treatment. For the rest of localities, the health

centre only performs the preventive function as the preventive health centre formerly. The application of a model depends on the actual situation of each locality, and it is decided by the provincial People's Committee leadership.

## **2.2. Health financing system**

### ***2.2.1. Flows of financing for the Vietnam health care system***

The transition from a centrally planned economy to a market economy since the application of the "Doi moi" (renovation) policy in 1986 has brought many remarkable changes in the health care system of Vietnam in general, and in the health financing system in particular. The health financing system has become a multi-source system rather than a system purely reliant on the government budget and external aid as in the past. Figure 2 describes the flows of health financing flows in Viet Nam and shows the financial flows from the contributors (the people, enterprises) to the fee collecting/pooling units, to the fund management units and finally to the service providers. Two major public financial flows supply funding to health care in Viet Nam, namely the state budget and the social health insurance fund. In recent years, to provide improved health care for the poor, the Government has allocated state budget to the health insurance fund as a way of purchasing health insurance for the poor and those eligible for social policy entitlements. Apart from those two public finance mechanisms, another relatively large financial flow is household direct out-of-pocket payments to service providers or to pharmacies to buy drugs when ill. Besides, ODA and private spending from other sources (e.g. private enterprise health clinics, NGOs, etc.) also provides funding for health but account for only a small part of total health expenditure.



**Figure 2: National Health System Financing Flows of Vietnam**

Source: Reproduced from Somanathan et al.(2014) (Somanathan, Tandon, Dao, Hurt, & Fuenzalida-Puelma, 2014)

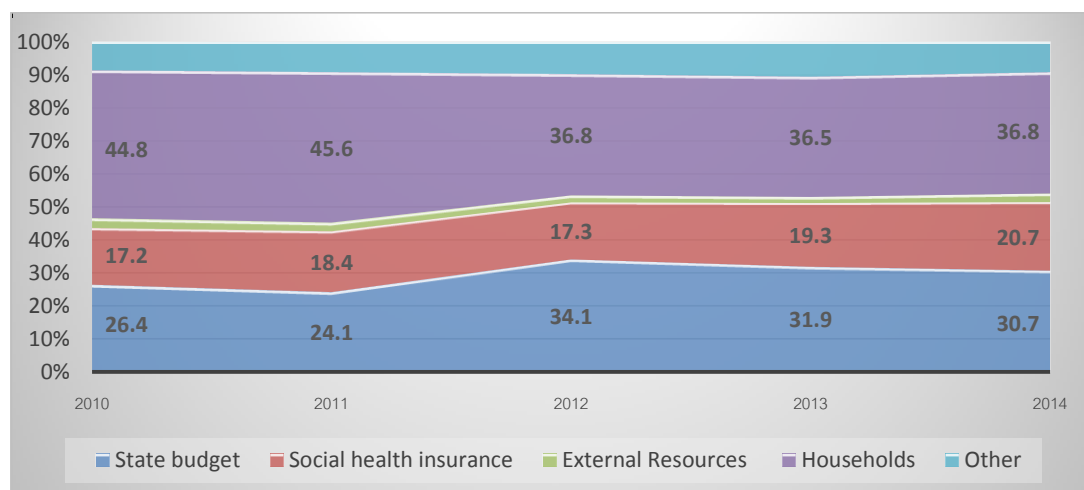
### 2.2.2. Structure of health financing resources

The health financing system in Viet Nam is multi-sourced, mobilized from governmental budgets, social health insurance funds, external sources and non-governmental organizations, and direct household payments.

Figure 3 shows the contribution to public financing from health insurance (including state budget subsidies for health insurance premiums for target groups) increased from 17.2% in 2010 to 20.7% in 2014 and the contribution from the state budget increased from 26.4% to 30.7% while external source for health has been maintained even though Vietnam has become a lower middle income country. As a result, out-of-pocket spending of

<sup>3</sup> Preventive Medicine is also District Health Center

households on health as a share of total health spending decreased from 44.8% in 2010 to 36.8% in 2014, however still accounts for the second large share of THE and higher the recommend of World Health Organization.



**Figure 3: Structure of health financing resources (2010 – 2014)**

*Source: National Health Account 2016*

### **2.2.3. Purchasing service from Social Health Insurance Fund**

#### **2.2.3.1. Health insurance history and development**

From 1992 to 2008, many legal documents on health insurance was provided to make the legal basis for the implementation of health insurance policies, contributing positively to create a financial source for protection and improving people's health.

SHI was promulgated first in 1992(Council of Ministers, 1992), covering civil servants, workers in the formal sector, staffs of international organizations, pensioners and socially aided people. However, workers' dependents were not affected by this decree. At that time, it was a multiple fund with the involvement of all provincial health insurance agencies. The premium rate for participants was 3% of their salary, of which employees contributed 1%, and employers contributed 2%. Five years later, in 1998, this decree was replaced by Decree 58/1998/ND-CP(The Government of



Vietnam, 1998) on not only expanding the coverage of health insurance but also unifying all provincial health insurance funds into a single fund. After that, Decree 63/2005/ND-CP continued to enlarge the participants, including workers in the enterprises less than 10 employees, the poor, and veterans.

However, to institutionalize the system of legal documents on health insurance, the Health Insurance Law No. 25/2008/QH12 has been approved in 2008. The content of Health Insurance Law has overcome the difficulties and shortcomings in the implementation of the health insurance policy to achieve the direction of equity, efficiency and development. The HI enrollees were divided into 25 groups with the premium rate for participants was 4.5% of their salary, of which employees contributed 1.5%, and employers contributed 3%. The benefit package is quite comprehensive, including the inclusive list of technical services (43/2013/TT-BYT(Vietnam Ministry of Health, 2013a), even covering almost high-tech medical services (Decision No.36/2005/QD-BYT(Vietnam Ministry of Health, 2005a)); the drug list with more than 1000 modern medicine and 127 traditional medicine (Decision No. 05/2008/QD-BYT(Vietnam Ministry of Health, 2008a)); and the list of rehabilitation services (No.11/2009/TT-BYT(Vietnam Ministry of Health, 2009)).

After three years of implementing, the National Assembly promulgates the Law on amendments to some articles of the Law on Health Insurance No. 25/2008/QH12. Accordingly, the major changes as follows: (i) expanding the coverage; (ii) Social insurance has responsibility for paying health insurance for maternity leaving; (iii) new regulations on issuing health insurance cards for children under 6 years old; (iv) changing in subsidized rate among different groups; and (v) increasing sanction to enterprises for evasion of paying health insurance.

Table 1 provides the information about current health insurance membership, premiums and premium subsidies by group.

**Table 1: Current health insurance membership, premiums and premium subsidies by group**

<b>Group</b>	<b>Membership categorizes</b>	<b>Premiums and Premium subsidies</b>	<b>Co-payment</b>
<b>1.</b>	<b>The group whose insurance are paid by employers and employees</b>		
	- Worker, managers of enterprises, and civil servants	6 % of their salary, of	20% of co-payment
	- Part-time officers in communes, wards and towns	which employees contributed 2% and employers contributed 4%.	20% of co-payment
<b>2.</b>	<b>The group whose insurance are paid by the social insurance organizations</b>		
	- Pensioners	6% of retirement pension	5% of co-payment
	- Persons receiving monthly social security allowance due to occupational accidents of diseases.	6% of base salary	20% of co-payment
	- Retired commune civil servants who receive a monthly social security allowance		20% of co-payment
	- Persons receiving unemployment benefits	6 % of unemployment benefits	20% of co-payment
<b>3.</b>	<b>The group whose insurance is paid by the State budget</b>		
	- Commissioned officers, professional soldiers	6% of base salary	
	- Retired commune civil servants who receive a monthly pensions funded by the State Budget		20% of co-payment
	- Person no longer receiving compensation for loss of capacity for work and being		20% of co-payment

	receiving monthly pension funded by the State Budget		
	- Persons performing meritorious services in the wars, war veterans		
	- Member of the National Assembly and People's committees		20% of co-payment
	- Children under 6		
	- Persons who receive a monthly social protection allowance		20% of co-payment
	- The very poor and members of ethnic minorities living in disadvantaged areas		
	- Dependants of person awarded for revolutionary merit		20% of co-payment
	- Organ donors		20% of co-payment
	- Foreigners studying in Vietnam on Vietnamese government fellowships		20% of co-payment
<b>4</b>	<b>The group whose insurance are supported by the State Budget</b>		
	- The near poor	6% of base salary	5% of co-payment
	- Schoolchildren and student		20% of co-payment
<b>5</b>	<b>The group of the household insurance are paid by household</b>		
	<p>The premium of the first one must not exceed 6% of base salary</p> <p>The premium of the second, third, fourth ones shall be equal to 70%, 60%, 50% of the premiums of the first one respectively,</p> <p>The premiums of fifth one and the followings shall be equal to 40% of the premiums of the first one.</p>		20% of co-payment

### 2.2.3.2. *Provider-payment methods*

According to HI law, three provider-payment methods can be applied at government health facilities, including: Fee-for-service; capitation and case-based payment.

#### ***Fee for service***

Fee-for-service is the major method with 64.5% health care facilities nationwide using this method in 2012(Health Strategy and Policy Institute, 2015). Fee-for-service payment was officially introduced as a payment method for the social health insurance agency in 1995 after the legalization of user fees collection at government health facilities. Then, each province applies that schedule to establish its fee schedule approved by the Provincial People Committee. However, there is lack of consistent and concrete guidelines for adapting national fee schedule at province level.

After many years of implementation, the national fee schedule has been updated for four times in 1995, 2006, 2012 and 2015. Circular 37/2015/TTLT-BYT-BTC regulates the most recent update on the uniform price of medical examination and treatment services for insured patient among the same ranking hospitals in the whole country. Regarding the circular, the hospital fees at the same level health facilities are added two more components of surgery allowance and wages. As result, after four updated times during almost 30 years of implementation, the fee level was calculated on the cost basis of four out a total seven input cost components of each service including (i) Medicine, blood, intravenous fluids, chemicals, consumable materials; (ii) utilities such as water, electricity, and fuel; (iii) maintenance of medical equipment, (iv) salaries, allowances and other contributions. Fee schedule covers ordinary examination, specialty consultation, inpatient stay, lab test, diagnostic test, outpatient procedures. There is no fee schedule for preventive services which mostly free of charge, basic primary care at commune health station, medicine as well as transportation and referral to a higher level.

### ***Capitation***

Capitation payment was applied first to mainly district level in 2004 for both of outpatient and inpatient services. After that, the Health Insurance Law, which has been approved by National Assembly in 2008 and has taken into effect on 1st of July 2009, indicates that capitation payment is one of three provider payment methods (PPMs) in health insurance scheme. Decree 62/2009/ND-CP guiding implementation of Health Insurance Law strongly has affirmed the capitation would be applied at primary care facilities. Besides, Circular 09/2009/TTLT-BYT-BTC has identified the roadmap of applying for the capitation payment. Regarding the guideline, capitation payment mechanism would be applied for 30% of total health facilities contracting for providing health services for the registered HI enrollees by the year 2011, then increase up to 50% by the year 2013 and reach to 100% by the year 2015.

In the 2004 capitation model, the capitation fund was an amount calculated by the number of health insurance card registered at district health care facility and the base rate had been determined. The capitation rate was calculated for each group for each province. The capitation fund allocated to a health care facility was the total capitation fund of six member groups, including:

- Group 1: civil servants and formal sector workers
- Group 2: pensioners, meritorious people, beneficiaries of social security/ protection allowances, veterans
- Group 3: the poor and near poor
- Group 4: children under six years of age
- Group 5: schoolchildren and students
- Group 6: voluntary members

The capitation fund for each group was calculated as the following formula:

$$\text{The capitation fund of group } i \text{ in the province } j = \frac{\text{The total health expenditure of group } i \text{ covered by health insurance for the province } j \text{ for the previous year}}{\text{The total number of group } i \text{ members for the province } j \text{ for the previous year}} \times K$$

K: Adjustment coefficient due to fluctuations in costs of medical examination and treatment and other related factors of the next year compared to the previous year

In 2011, Vietnam Social Security (VSS) had reported in 62/63 provinces applied the old capitation. There was a total of 902 out of 2453 facilities applied capitation mechanism, accounting for 42% of those having a contract for providing health services for the registered HI enrollees (Vietnam Social Security, 2013). However, there were some variations on the capitation applied in Vietnam compared to the international experiences (Health Strategy and Policy Institute, 2013). The 2004 capitation payment in Vietnam has many shortcomings related to both of designing and implementing. Firstly, capitation payment in Vietnam is quite comprehensive, including outpatient, inpatient, referrals, and even self-referrals to higher levels while package of services from numerous successful international examples limited to primary care. Secondly, base rate of capitation in Vietnam is calculated from historical expenditures and fee schedule rather than based on the actual cost of using services, resources available, policy considerations and negotiations with purchaser.

District hospitals receive a capitation fund that is constructed from the number of individuals from each of Vietnam's six different insured population groups enrolled with the hospital multiplied by the average per capita historical expenditure for each group. Thirdly, some facilities are using a lot of high cost services such as heart surgery, renal dialysis, hemophilia, cancer treatment, transplantation which are not included when calculation the capitation fund. Fourthly, there is an adjustment coefficient to the capitated rates, but it is a flat-rate 1.1 adjustment coefficient across all groups, districts and provinces, so the adjustment does not serve the typical function of adjusting payments to compensate providers for systematic cost differences across population groups. Consequently, the deficit situation of capitation fund as well as the pressures of fund management lead to many health facilities do not want to participate in capitation(Vietnam Social Security, 2011).

To overcoming these problems, on March 2013, the Minister of Health has decided to establish a Steering Committee and a technical group. After that, the Minister issued Decision No. 5380/QD-BYT on December 30, 2013, for approving the project on piloting "new" capitation(Vietnam Ministry of Health, 2013b). The ultimate aim of the project was to provide the scientific and practical basis for revising the capitation payment as stipulated in Circular No. 09/2009/TTLT-BYT-BTC. Criteria to select provinces in pilot project as follows: (i) high commitment from local leadership (including leadership at Department of Health and Provincial social security); (ii) the rate of health insurance coverage more than 50%; (iii) the diversified topography among districts and (iv) having a good information system. Accordingly, four provinces are selected including BacNinh (Red River Delta of the northern part), NinhBinh (the south of the Northern Delta), ThuaThienHue (North Central Coast) and Khanh Hoa (South Central Coast). In this project, two models were applied: (1) Capitation for outpatient services with exclusion of some high tech and high cost services and referral payment, FFS for inpatient

services at BacNinh and NinhBinh province; (2) capitation for outpatient and inpatient services with exclusion of referral payment and some high tech and high cost services at ThuaThienHue and KhanhHoa province.

There are some variations between old capitation and new capitation. Firstly, scope of services covered by capitation mechanism just focus on primary care. This is in line with the principle and practice of capitation in some countries in the world. Secondly, applying payment ceiling (a “hard cap” rate) helps to control the treatment cost at the rate allowed. In other words, if the health facility use exceeded the allocated capitation fund, the social security will not pay. In the other word, health facilities must balance the fund by themselves. Thirdly, the calculation of base rate follows the principle of determining the general average base rate, and then is adjusted by the coefficient according to six health insurance groups. The details of formulas in the pilot capitation as follow (Vietnam Ministry of Health, 2013b):

*Total capitation fund at district health facilities*

Total capitation fund = P \* Total health insurance fund for the next year

P: the proportion of health insurance payment on services covered by capitation for the previous year

*Option 1: outpatient services:*

$$P1 = A1/Q$$

P1: the proportion of health insurance payment on OP services at district level and lower

A1: Total health insurance payment on OP services at district level and lower

Q: Total health insurance medical services reimbursed by social insurance for the previous year



*Option 2: both of outpatient and inpatient services:*

$$P2 = A2/Q$$

P2: the proportion of health insurance payment on OP & IP services at district level and lower

A2: Total health insurance payment on OP & IP services at district level and lower

Q: Total health insurance medical services reimbursed by social insurance agency for the previous year

*Average base rate adjusted by cost coefficient:*

The average base rate is determined by the total capitation fund and total number of health insurance cards registered at district level and lower, and then then is adjusted by the coefficient according to six health insurance groups.

*Calculation of coefficients for each of the health insurance groups*

$$TY = \frac{\frac{C(m)}{TT(m)}}{(\sum_{i=1}^6 \frac{C(i)}{TT(i)})/6}$$

TY: Cost coefficient for each group

TT: Total number of HI cards for the province for each group for the previous year

C: Costs of health insurance medical services

- Option 1: Costs of OP services at district level for each group for the previous year

- Option 2: Costs of OP+IP services at district level for each group for the previous year

m, i: Health insurance group

*Calculation of average base rate adjusted by cost coefficient:*

$$BR = \frac{TQ}{\sum_{i=1}^6 (TT(i) * TY(i))}$$

BR: Adjusted average base rate

TQ: Total fund for health services

- Option 1: Total fund for OP services

- Option 2: Total fund for OP & IP services

TY: Cost coefficient for each group

TT: Total number of health insurance cards for each group in the year

i: Health insurance group i (from 1 to 6)

### ***Case-based payment***

Case-based payment is now piloted at two hospitals in Hanoi for four disease groups (acute appendicitis, normal delivery, bronchitis in children and adults). Diseases related group (DRG) payment especially Thailand's experiences have been studied to apply for inpatient services in Vietnam. Ministry of Health of Vietnam has developed a Pilot project of DRG and the roadmap to the year 2020. The proposal is on the process of getting comments from related ministries and sectors (Health Strategy and Policy Institute, 2015).

### **2.3. Vietnam Primary Care costing teams**

In the recent years, the Joint Learning Network for Universal Health Coverage (JLN) and The World Bank (WB) has been supporting the Vietnam Ministry of Health (MOH) in conducting costing studies to provide cost estimates and inputs into the future development of other provider payment models such as capitation or case-based hospital payment using diagnosis-related groups (DRGs).

A group of technical experts and policymakers from different

departments and institutions were convened by MOH to join the process of planning and implementing the costing exercise. They embrace MOH Department of Health Insurance, MOH Department of Planning and Finance, Vietnam Social Security, Health Strategy and Policy Institute (HSPI), Hanoi Medical University (HMU), Provincial departments of Health and Hospitals.

There are several samples in the toolkit from JLN, including costing instruments & models, and simulation analyses. The first phase developed to finalize the study methodology, select the sample, design and pilot the data collection instruments in Thai Nguyen and Hai Duong provinces for estimating the unit costs of primary care visits (OP visits) at district and commune levels. The study conducted at 76 commune health stations in 2013 (results mentioned in literature review). Although results from this costing study also provided policy-makers with a simple picture of health service costs to inform policy discussions, this be emphasized only preliminary results. It is necessary to add more primary health facilities for a larger and more representative sample in the next phase of the costing study. The calculation of base rate will be more realistic with the comprehensive and detail data for reforming the PPMs (Minh et al., 2015). Besides, for informing negotiations in Vietnam, the second phase finished with using a simulation model to compare “the current state” with different scenarios of provider payment reform in three provinces of Vietnam. The results of the simulation models provided evidence for policy-makers to assess different alternative solutions and make decisions about new models to achieve health system objectives (Cashin, Phuong, Shain, Oanh, & Thuy, 2015).

#### **2.4. Background information of health facilities**

The calculation of unit cost will be conducted at 33 district hospitals/ district health centres in BacNinh, NinhBinh, ThuaThienHue and KhanhHoa.

In Vietnam, the classification and definition of cities are determined by centrally governmental decisions based on certain criteria such as area, population, the development of infrastructure and socioeconomic and political importance. Some cities in Vietnam are provincial-level administrative units, called centrally-run cities. The other cities are district-level administrative units, called provincial cities. In the four study provinces, except for Khanh Hoa, there are two cities in the province, the others have only one city. Therefore, about administrative structure, BacNinh provinces has seven district hospitals and one province health centre; NinhBinh provinces has seven district hospitals and one city health centre; ThuaThienHue province has eight district health centres and one city health centre; and KhanhHoa province: six district health centres and two city health centre. District hospitals only perform the curative function while district health centres perform both functions of prevention and treatment (Table 2).

**Table 2: Type of health services provision at each district health facility**

No.	Health facility	Outpatient	Inpatient	Prevention
<b>BacNinh Province</b>				
1.	YenPhong DH	√	√	-
2.	QueVo DH	√	√	-
3.	GiaBinh DH	√	√	-
4.	LuongTai DH	√	√	-
5.	ThuanThanh DH	√	√	-
6.	TienDu DH	√	√	-
7.	TuSon DH	√	√	-
8.	BacNinh CHC	√	-	√
<b>NinhBinh Province</b>				
9.	GiaVien DH	√	√	-

10.	HoaLu DH	√	√	-
11.	KimSon DH	√	√	-
12.	NhoQuan DH	√	√	-
13.	YenKhanh DH	√	√	-
14.	YenMo DH	√	√	-
15.	TamDiep DH	√	√	-
16.	NinhBinh CHC	√	-	√
<b>ThuaThienHue Province</b>				
17.	ALuoi DHC	√	√	√
18.	HuongThuy DHC	√	√	√
19.	HuongTra DHC	√	√	√
20.	NamDong DHC	√	√	√
21.	PhongDien DHC	√	√	√
22.	PhuLoc DHC	√	√	√
23.	PhuVang DHC	√	√	√
24.	QuangDien DHC	√	√	√
<b>KhanhHoa Province</b>				
25.	CamLam DHC	√	√	√
26.	DienKhanh DHC	√	√	√
27.	KhanhSon DHC	√	√	√
28.	KhanhVinh DHC	√	√	√
29.	NinhHoa DHC	√	√	√
30.	VanNinh DHC	√	√	√
31.	CamLam DHC	√	√	√
32.	CamRanh CHC	√	√	√
33.	NhaTrang CHC	√	√	√

*DH: District Hospital; CHC: City Health Centre; DHC: District Health Centre*

Regarding the Prime Minister's Decision No. 181/2005 / QD-TTg dated July 19, 2005 on the categorization and classification of public non-business organization, all public health facilities are considered and classified. The classification of public health facilities is determined by the following rules: (i) Position, functions and tasks; (ii) the size and scale of the activity; (iii) Labor structure and level of qualifications; (iv) professional competence, quality of services; and (v) infrastructure and equipment. Based on the criteria and ranking sheets, all of the hospitals selected by the study are third-class hospitals.



## **CHAPTER 3**

### **LITERATURE REVIEW**

This section is going to mention to four parts, including 1) An overview of the methods used to calculate unit costs; 2) Examples of specific countries in choosing the costing methodology; 3) Studies on costing have been conducted in Vietnam; and 4) Studies on contributing factors to unit cost.

#### **3.1. An overview of the costing methodologies**

##### ***3.1.1. Accounting versus economic costs***

Financial costs are defined as the actual money spent on the resources which include costs of personnel, supplies, maintenance, etc. Therefore, it is important in budgeting and planning. The economic cost of a resource depends on its opportunity cost, in other words, it mentions to the best alternative foregone (Woderling, Gruen, & Black, 2005).

Financial accounting involves identifying, measuring, recording, and communicating in the economic events and the status of an organization. In the implementation of the accounting concepts, there are two different methods have been applied, including cash accounting and accrual accounting. Firstly, cash accounting (cash basis accounting) is the most important event to record the receipt of cash instead of the service provision. In other words, cash accounting records the actual flow of money into and out of a health facility. Secondly, accrual accounting (accrual basis accounting) implies that revenue earned does not necessarily correspond to the receipt of cash. Two key components of accrual accounting include revenue recognition and matching. The first one requires that revenues be recognized in the period when they are realizable and earned. The second one requires that an organization's expense be matched, to the extent possible, with the revenues to which they are related (Gapenski, 2008).

In general, financial accounting can be as reporting work while managerial accounting is best describes as decision work. Managers are more concerned with what will happen in the future than with what has happened in the past. Unlike financial accounting, managerial accounting is for forward-looking, and as a result, it focuses on meet the needs of managers within the organization (Gapenski, 2008).

A costing exercise can be calculated by several ways. Selecting the best method depending on many criteria that include (a) the purpose of costing, (b) the objective of costing and (c) the perspective of the study.

### ***Purpose of costing***

Defining the purpose of a costing exercise is not only the first step but also the most important step in the action plan. Whether the process of costing measurement for the purpose of examining “the change in cost among alternative solution” or “accounting and reporting”. The accounting and economics literature present many different methodologies for identification, measurement and valuation of resource use in costing exercise (Brouwer W, Rutten F, & M, 2001; Mogyorosy & Smith, 2005; Özaltın et al., 2014; Shepard et al., 1998). They include activity-based costing, average costing, cost-benefit analysis, cost-effectiveness analysis, nominal costing, standard costing, and so on.

Cost accounting methods (or full costing), as the term implies, use accounting principles to classify and measure all direct and direct costs incurred in carrying out an activity for the purpose of planning and budgeting, setting provider payment rates and improving management and performance (McGuigan JR & Moyer RC, 1993; Smith & Barnett, 2003). Analysis of full costing helps determine any provider whether or not is achieving value for money. It also can make a cost comparison among departments within a health facilities or between regions and countries as well(Lucey, 2002).



Economic methods, by contrast, often focus on statistical analysis of marginal costs to understand the change in cost as a result of a change in activity. In the other words, this approach requires a calculation of the costs of one additional unit services. It determines the difference among alternative solutions and its impacts on any changes in decision making such as adding or dropping a service (McGuigan JR & Moyer RC, 1993; Smith & Barnett, 2003). Because of unchanged the fixed costs, marginal costs just focus on variable costs. However, due to the difficulty in determining the fixed, variable and semi-variable cost, marginal costing can be more challenging.

### ***The objective of costing***

An economic or accounting cost analysis will be undertaken depends on objectives of the study (Creese & Parker, 1994). Some objectives inform the provider payment reform effort, and others inform priority-setting exercises. For instance, the financial cost analysis may be necessary for calculation costs of expanding health coverage, estimate a cost basis for cost recovery or provide data to hospital managers for improving operations (Özaltın et al., 2014). Whilst the economic costs help a cost-effectiveness analyses among alternatives in the near future which consider the opportunity cost carefully. The best alternative should be used when the value of resources are equal to the costs (McGuigan JR & Moyer RC, 1993; Smith & Barnett, 2003). By specifying in advance what the costing exercise intends to achieve, researchers will maximize their time and resources during implementation and policymakers will obtain timely results in the desired format (Özaltın et al., 2014).

### ***Perspective of study***

The perspective defines the point of view from which stakeholder's costs should be taken into account (Drummond, Sculpher, Claxton, Stoddart, & Torrance, 2015; Elliott & Payne, 2005; Luce, Manning, Siegel, & Lipscomb, 1996; Mogyorosy & Smith, 2005). The costing exercise is performed from (a)

patient (first party), (b) provider (second party), (c) purchaser (third party) and (d) societal perspective.

An organizational perspective is most often adopted to understand the costs of health services from the point of view of the purchaser or the provider. The purchaser perspective estimates the costs to cover a service for beneficiaries. This perspective is used for improving purchasing practices to maximize health outcomes with budget constraint. On the other hand, the provider perspective estimates the costs to deliver the health service. This perspective is useful for informing the actual cost of services provision in negotiations with purchasers, establishing fee schedules, and improving the efficiency of activities.

If a payment method intends to expand coverage with the aim of reducing out-of-pocket spending, understanding costs from the patient perspective may be useful. The patient perspective can capture the non-health services costs, such as transportation cost, caregiver expenses or even foregone income (i.e., lost wages due to the illness).

A societal perspective analyses all the costs to society as a whole rather than solely the costs for purchasers, providers, or patients directly involved. This perspective requires more extensive data which used to employ in economic evaluation such as CEA and CBA(Drummond et al., 2015).

### ***3.1.2. Costing approaches for the purpose of provider payment***

#### ***3.1.2.1. Costing approaches***

Cost accounting methods are preferred over economic methods to estimate unit costs of health services for the purpose of provider payment (Özaltın et al., 2014; Tan, Rutten, van Ineveld, Redekop, & Hakkaart-van Roijen, 2009; Wordsworth, Ludbrook, Caskey, & Macleod, 2005). The decision making of provider payment relies on the average cost information,

which is the result of analyses using cost accounting methods. Top-down, bottom-up and mixed methodologies are frequently used in the accounting methods.

### ***Top-down approach***

The top-down approach is a process of separating the total cost into the unit of services such as the number of visits or the number of the treatment day. The total cost is allocated to “cost centre” (facility’s departments), then identify the number of services in each group, and finally assign to the unit of services (e.g. patients treated or some hospital days.) (Beecham, 1995; Muenning & Khan, 2002; Waters & Hussey, 2004).

The top-down method is known to be less costly, less time-consuming and also can be more comprehensive (including all the relevant costs) than bottom-up (Beecham, 1995; Muenning & Khan, 2002; Street & Dawson, 2002; Waters & Hussey, 2004). A top-down approach is less detailed and low accuracy because they are constructed from aggregate data. Due to top-down approach is using hospital information system from accounting and statistics instead of using medical records and billing, it does not allow detailed analysis of patient-level (Bailey, 1997; Edbrooke et al., 1999; Lievens, van den Bogaert, & Kesteloot, 2003; Marlene Gyldmark, 1995).

### ***Bottom-up approach***

The bottom-up approach is also called micro-costing or activity based costing. It measures directly the inputs which are used to provide services. For this method, it measures the actual quantity of resources consumed by the service/patient, attaches a unit cost to each of those resources, and then sums the unit costs to calculate the total service/patient cost. For measuring resources at the service/patient level, primary data collection is often required. The methods for measurement the resource used (Houweling, Bolton, & Newell, 2014; Smith & Barnett, 2003; Zimmerman & Yahya-Zadeh, 2011): (i)

time and motion studies, (ii) account classification for estimating the fixed and variable costs, (iii) activity logs, (iv) management surveys, (v) self-report questionnaire, (vi) patients diaries, (vii) direct observation, and (h) the medical record reviews

The bottom-up method produces more detailed and accurate cost data for each disease and patient treated at hospitals. It can be more easy to use in the fee-for-service system (Beck et al., 1999; Marlene Gyldmark, 1995; Murray, Hannam, & Wong, 2005; Waters & Hussey, 2004). However, implementation is more complex due to reliance on primary data collection. Moreover, it is also more time consuming and costly.

### ***Mixed methodologies***

The fundamental difference between the two methodologies is that the bottom-up approach relies on detailed costing while the top-down approach is based on average costing. As each method has its inherent strengths and weaknesses, researchers sometimes employ both top-down and bottom-up approaches in the same costing exercise. Some of the disadvantages of both methods could be avoided when using the mixed approach. Because the mixed method can decide where they will rely on direct cost measurement, and where they use databases, it will be cheaper than using only bottom-up approach and more accurate than using only top-down approach (McDaid, Byford, & Sefton, 2003; Swindle, Lukas, Meyer, Barnett, & Hendricks, 1999).

#### ***3.1.2.2. The selection of costing approach***

Applying the approach of top-down, bottom-up or both of them depend on some follow factors:

### ***The orientation of study***

A costing study can apply either a backward-looking (retrospective) or forward-looking (prospective) approach. While the objective of retrospective studies is to review the resources that have been utilized to estimate their cost, prospective ones aim to calculate the cost associated with resources that have not been used yet in a specified time period. Hence, the data required in two types of costing study are somewhat different. By analysing data retrospectively, the data on utilization and related spending have been already created and possibly gathered. In contrast, prospective studies used the data that are not available in the phase of study design; therefore, the data would be collected as primary data. Although it is commonly easier to conduct backward-looking studies as the data have been collected, these studies are more likely to suffer from greater constraints. The accuracy and reliability of the costing outcomes can be affected by the availability, quality, and transparency of the previously generated data. A forward-looking study can be more challenging to be implemented; however, such a study allows researchers to control better and flexibly measure the resources.

As the top-down costing depends on a financial account and other databases, a retrospective approach is used. On the other hand, bottom-up costing study can collect the data either prospectively or retrospectively using patient records, surveys, forms or other reliable data sources (Luce et al., 1996; Slothuus, 2000). If the data are not retrieved from reliable databases, the bottom-up approach is recommended (Jegers, Edbrooke, Hibbert, Chalfin, & Burchardi, 2002; Luce et al., 1996; Muenning & Khan, 2002).

### ***Time horizon***

The purpose of study and the selected perspective could affect to the time period of the study. Costing exercises can be conducted based on data from a year or over the years. However, the selected data period could have an

impact on the cost of services. It will determine which costs should be involved in the study to avoid the cost changing by time. Besides, the timing is also important in converting the cost in the same year which can ensure the comparison (Brouwer W et al., 2001; Muenning & Khan, 2002; Oostenbrink, Koopmanschap, & Rutten, 2002).

For a retrospective costing exercise, a one-year which captures one budgeting cycle and evens out seasonal fluctuations is the ideal time horizon. For a prospective costing exercise, a shorter period is more feasible (often less than one year) due to the primary data collection is more time-consuming and costly than using historical data.

### ***Cost object***

The data which serve for developing provider payment method include different levels of data such as organizational, departmental/specialty, service, or patient level(Özaltın et al., 2014). The data input for constructing unit cost at the organizational level are total unit of service and the total facility cost. The revenue of a facility can be considered as department or specialties related cost. The construction of unit cost can be used for many provider payment methods, including case-based, per diem, or global budget. Additionally, the service cost units create cost associated with each service or package of services provided by facilities. Developing fee schedule can be informed by a costing study with a service cost unit. Lastly, a patient cost unit creates cost for all the services that are delivered to a patient with specific characteristics. The mean cost per patient can be used for adjusting payment rates, for example, age/sex adjustments to capitation rates.

Top-down approaches can be applied at organizations, departments/specialties, and services/patients. Meanwhile, bottom-up approaches just measure most of the resource use at the service or patient level(Evers et al., 2004; Marlene Gyldmark, 1995; Nelson-Conley, 1995).

### 3.1.2.3. *Cost allocation*

There are four methods available to allocate the costs from Administrative departments (i.e., nonrevenue cost centres ) and Clinical Support departments (i.e., revenue cost centres) to the Clinical departments (direct cost centre): (i) Direct method, (ii) Step-down method, (iii) Double distribution, and (iv) reciprocal distribution (Drummond et al., 2015; Ellwood, 1996; St-Hilaire & Crépeau, 2000; Young, 2004). Administrative departments (nonrevenue cost centres) which provide overhead support services to other department. Para-clinical departments (revenue cost centres) which provide clinical support such as tests, imaging services, etc. to clinical departments; and (3) Clinical departments (direct cost centre) which provide direct care to patient with units of services are outpatient visit, discharges and bed-days.

The direct method simply allocates the costs from nonrevenue centre and revenue cost centre to final cost centres directly. This method reflects the causal relation between the used resource and cost by using a proxy measure. For example, the measurement of square meter in floor area is the proxy for electricity consumption of each department. However, this method is low accuracy because the nonrevenue cost centre do not allocated the cost to the revenue cost centre.

The step-down method allocates nonrevenue centre costs to both nonrevenue and revenue centres in a step-wise fashion. After that, all the costs of the higher clinical support centre are allocated to lower cost centres, and this process continues until all the costs are allocated to clinical centres. However, the cost of revenue cost centre is not allocated to nonrevenue cost centre.

Double distribution allocates the costs of each cost centre to all other cost centres, using the step-down with iteration. The cost of nonrevenue cost centre and revenue cost centre are allocated to the final cost central, and also to each other.

Reciprocal distribution is also called the simultaneous equation method. This method allocates the costs of each cost centre to all other cost centres, using algebraic equations. Firstly, the equation equals to the total overhead cost of each department. Then, the value of one of the variables in one equation can be substituted and solved. Finally, it will be plugged in the other known value and solved for the final overhead cost. This can be the most accurate method, but it is difficult to implement because of complexity.

#### ***3.1.2.4. Joint Learning Network Toolkits***

Joint learning Network has been supported Vietnamese MOH in designing and implementing a costing exercise for primary care services provided at district hospitals and CHSs. A toolkit includes samples of costing instruments, costing models and dummy tables has been provided to costing team. Costing instruments include data collection templates for top-down costing of district hospitals and commune health stations. There are two workbooks which contain tabs for general information, utilization, revenue, personnel, drugs, recurrent expenditures, building, medical equipment, and non-medical equipment. Costing models is step-down technique for district hospitals/health centers to allocate the cost from less direct patient care cost center (administrative departments) to more direct patient care cost center (Para-clinical departments) and to final cost center. Dummy tables on presenting the results of fees, unit costs and cost structure.

### **3.2. Examples of specific countries in choosing the costing methodology**

Studies on analyzing the hospital cost have conducted in many developed and developing countries. Almost studies are using the secondary data from hospitals' activity and accounting reports for the purpose of providing evidence for financial management and planning at hospitals. These studies provide hospital's cost structures in evidence to managers which help to



run their hospital more efficiently with lower cost. This part presents some studies which has been done before, using different costing methodology.

Suphanchaimat et al. (1998) determined the unit cost of outpatient and inpatient services, and then compared it among two fiscal years of 1996 and 1997 in Khon Kaen Hospital. This study was conducted retrospectively, using the secondary data. The simultaneous equation method was applied to allocate the cost. The results found that the direct cost of outpatient service and inpatient service in 1997 was increasing compare to 1996. However, the cost ratio of labour : material : capital was similar (49 : 44 : 7) (Suphanchaimat, Patcharanarumol, Udombua, & Phuthorn, 1998).

Olukoga A (2007) calculated the unit costs of providing the inpatient services in five district hospitals of South Africa, including admissions, average length of stay and inpatient days. For provider perspective, combining top-down approach and step-down sequence was applied. This study indicated the unit costs of inpatient days were variation among study hospitals (\$38.04-\$103.68). The unit costs of medical patients were less than 2 times compare to maternity patients. Personnel costs accounted for a highest share in cost component (73%-82%) (Olukoga, 2007).

Aboagye et al. (2010) estimated the full cost of healthcare delivery at a referral, a district and a mission hospital of Ghana. This study used the tools of standard cost-finding recommended by WHO to analyze the hospital data in 2002 and 2003. The step-down method was applied to allocate the cost from supporting cost centre to intermediate and final cost centre. The results showed that compare to 2002, the full costs of running all three hospitals in 2003 were increasing. Salaries were the major cost component with range 45% to 60%, while overhead costs made up between 20% and 42%. Besides, this study also emphasized user fee charge at all hospitals were below actual cost (Aboagye et al., 2010).

Younis (2012) conducted a retrospectively study to estimate the unit costs of patient-related services at public hospitals and primary healthcare centers in Palestine during the year 2008. The step-down technique was employed to allocate the cost. 75% of all costs is inpatient cost, whereas the remaining 25% of total costs is outpatient services. About the cost structure, salaries and wages constituted about 37%, drugs and consumables are 27%, overhead expenditure is 27%, and other expenditure is 8% of the total(Younis et al., 2013).

Chatterjee (2013) calculated the unit cost of health services in five different hospitals in India, including district care hospital, tertiary care hospital, charitable hospital, private hospital and private teaching hospital. This study employed the standard costing method with using the simultaneous equation method for cost allocation and straight-line approach for building and equipment depreciation. The results found the major cost component was human resources, capital cost and materials cost for the district and tertiary care hospitals, the charitable and private hospitals and the private teaching hospital respectively. Within each cost center at each hospital, the highest cost share was human resources, followed by materials cost. In addition, this study also suggested a future study on a larger scale for revising payment rates under health insurance scheme(Chatterjee et al., 2013).

Hammad et al (2016) carried out a retrospective analysis about the costs of outpatient and inpatient services at a 400-bed public urban hospital in Jordan. The average cost method was applied to calculate the unit costs. Hospital services were divided into ancillary supportive centers and direct patient care centers. The study showed that inpatient costs contributed more than a half of all costs whilst outpatient clinics consume less than 20%. Majority of the total hospital costs were labour costs (58.3%)(Hammad et al., 2016).

Prinja et al (2016) applied bottom-up costing method with provider perspective to calculate the cost on delivery of health services in fourteen Public Sector Primary and Community Health Centers in North India. Data were collected from several sources: records, reports, interview of key stakeholders, registers and facility observations. Similar to other studies, human resources constitute highest share of the overall costs (50%) at all facilities. Salaries were accounted for 52.6% of the total annual cost at a PHC. Besides, the costs on delivering a package of costs for provision of complete package of preventive, curative and promotive per capita per year services were also calculated at both of Public Sector Primary and Community Health Centers. Therefore, findings from this study could be used to revising payment rates under health insurance scheme(Prinja et al., 2016).

In addition, for the purpose of providing a costing exercise for provider payment, JLN constructed a manual and practical example to policymakers in low- and middle-income countries (Özaltın et al., 2014). This guideline gave the recommendations about unit cost need to be calculated as well as the costing methodology should be applied for each type of PPMs in the low and middle-income countries. For fee-for-service, bottom up is useful to calculate the average cost per service on the fee schedule. For capitation, using the top-down approach to calculating the average cost per patient per year. For per diem, the top-down is also applied to estimate the average cost per patient day in each department. Both of Case-based and global budget need to calculate the average cost per discharge by using top-down. Although most of the PPMs are recommended to apply the top-down approach, the case example in developing countries has been chosen a mixed methodology of combination top-down and bottom-up.

**Table 3: Examples of specific countries in choosing the costing methodology**

<b>Case example</b>	<b>Purpose</b>	<b>Methodology</b>
<b>Aarogyasri hospital, India</b>	to calculate the cost of 938 new benefit packages	The mixed method: <ul style="list-style-type: none"> <li>- top-down approach for calculation the operating costs and capitals cost</li> <li>- bottom-up approach for estimation the cost of benefit packages</li> </ul>
<b>Indonesia</b>	To calculate the cost of health services for the purpose of developing payment systems	The top-down approach
<b>Central Asian Republics</b>	define the weight coefficients for DRG through calculation the cost per bed-days	The mixed method: <ul style="list-style-type: none"> <li>- top-down approach for calculation the operating costs</li> <li>- bottom-up approach for obtaining allocation statistics.</li> </ul>
<b>Phil Health</b>	to shift from FFS to capitation payment	The mixed method: <ul style="list-style-type: none"> <li>- top-down approach for calculation the cost of resources</li> <li>- bottom-up approach for measurement personnel hours</li> </ul>
<b>Malaysia</b>	To assess the cost of delivering the health services and to calculate the budget	The mixed method: <ul style="list-style-type: none"> <li>- top-down approach for calculation the overhead cost, capital cost</li> <li>- bottom-up approach for obtaining the cost of laboratory tests and X-ray</li> </ul>

In summary, in the world, there were some studies calculating the cost of health services provision for management and planning in hospitals. Besides, these studies also emphasized the importance of costing data for purpose of providing to the policy-makers valuable information for revising the provider payment mechanisms. In fact, paying to providers must be determined according to the actual unit cost of health service to minimize the providers' incentives for using service too low or too high. In the other world, determining the actual unit cost is the success key of all provider payment mechanisms.

Constructing a unit cost of service that is right and adequate, is a complex task due to the difficulty of tracking data accurately as well as the allocation of cost. Choosing any approach (top-down, bottom-up or both of them) depends on the purpose, perspective, scope, cost objects and cost items selected. Although the bottom-up approach is accuracy, it is not preferred because of time-consuming and costly. The calculation of hospital treatment cost in several countries, including developed and developing countries is usually conducted retrospectively, using the top-down approach with step-down sequence or mixed methodologies. For the mixed methodologies, the top-down approach measured and valued personnel, drug/medical supply, overheads, and capital resource use. On the other hand, the bottom-up approaches were used to obtain allocation statistics for ancillary departments or to estimate the cost of specific episodes of illness. The data is collected within one year to avoid seasonal variation in disease patterns.

### **3.3. Studies on costing have been conducted in Vietnam**

Based on the results of the implementation studies on costing of health services provision in Vietnam, they are divided into four main groups, including (1) Studies on determining the cost of some treatment services, (2) Studies on determining the cost of some common diseases, (3) Studies on determining the cost of hospital among three levels of healthcare system, and (4) Studies on determining the cost of prevention and intervention activities.

#### ***Studies on determining the cost of some treatment services:***

In 2002, Chuc and Phuong carried out a study on identify the current cost of some health services at BaVi health center in Ha Tay. The cost of each service was determined and analysed base on the the principle of cost classification according to direct cost and indirect cost, then apply top-down approach using step-down technique for cost allocation. The information was

collected from the available sources (such as accounts system, the reports on operation situation in 2000) and direct interviews with the director and the head of function departments. The result showed the cost of full cost components (including staff salaries and allowances, medicines, medical supplies and consumables, operations (water, electricity, etc.) and minor repair/maintenance; training and research; capital depreciation) was higher than the current hospital fees from 2 to 12 times. In the full price, the costs for personnel and capital depreciation were fluctuated among medical services, accounting for 25% - 78% of total cost while the costs for maintenance, repairs and training were very limited (Chuc & Phuong, 2002).

Minh et al (2010) calculated the cost of clinical services at district hospitals in northern Vietnam for the purpose of estimation and analysis the actual unit costs of clinical services. There were three district hospitals involved in study: Dan Phuong hospital in Ha Tay province, Yen Dung hospital in Bac Giang province and Dai Tu hospital in Thai Nguyen. The results showed there were no major differences in the cost of outpatient among hospitals, however the cost of surgery and inpatient days differed markedly. About cost component, the highest proportions respectively were personnel cost and surgery cost while the smallest proportions were depreciation of building and equipment. Besides, the result found out the current hospital fees were lower than the real cost of providing services many time. Finally, the study emphasized the importance of costing data for management and planning in hospitals (Van Minh et al., 2010).

In 2015, under the supporting of JLN, study on costing of commune health station visits for provider reform in Vietnam was conducted. Totally, 76 commune health stations (CHSs) belong to 4 districts in 2 provinces were involved in study. The cost per outpatient visit was VND 49,521 (US\$2.40) in mountainous, VND 41,375 (US\$2.01) in rural and VND 39,794 (US\$1.93) in urban CHSs. The highest shares of total costs were personnel costs and drugs

respectively while the operating costs accounted for the minimal. Comparison between the actual cost by calculating and the hospital fees, CHSs were only recovered 18.9% of the total cost for an outpatient visit. As a result, this study provided to the policy-makers valuable information for revising the provider payment mechanisms (Minh et al., 2015).

***Studies on determining the cost of some common diseases:***

Minh et al (2009) estimated the treatment cost of some common diseases at Thanh Oai hospital in Ha Noi. The result showed that the average cost per outpatient visits, bed-day, blood test, X-rays, ultrasound and surgery was 12.700 VND, 102.400 VND, 20.400 VND, 32.450 VND, 45.730 VND, 1.512.720 VND respectively. The treatment cost of pneumonia, appendicitis surgery, normal delivery and hypertension was 1.007.674 VND, 2.987.453 VND, 3.908.453 VND, 1.077.004 VND respectively. Bed-day accounted for a large proportion in internal treatment while drug and depreciation cost accounted for a large proportion in surgery treatment (Minh & An N.T., 2009; Nhung, 2011).

Nhung (2011) studied on costing of diabetic patients at the Endocrinology Hospital in Binh Dinh province. The result found the median cost of diabetic treatment was 2.245.603 VND with the highest proportion was drugs (61,9%). There was no difference in cost among age groups, gender and occupation. However, the difference was statistical significance in treatment cost between urban and rural ( $P < 0,05$ ). The cost between two groups with and without health insurance was similar. The median treatment cost of patients with complications was higher 3.2 times compare to patients without complications. The median treatment cost of patients with both of complications and other diseases was higher than patients without complications 4 times (Nhung, 2011).

***Studies on determining the cost of hospital among three levels of healthcare system:***

Study on “Costing of health services at Vietnam hospitals in 2004” by Flessa and Dung from Heidelberg University, Germany determined the cost at one central hospital, two province hospitals and two district hospitals. The result indicated the average cost of bed-days in the central hospital was higher than provinces hospital and district hospital (3 times and 6 times respectively). However, the cost of some tests and surgeries at district hospital was higher than province hospital, or even central hospital. The major reason for this situation was little of tests and surgeries performing at the district level. This means some services and surgeries should not be applied at district level (Flessa & Dung, 2004).

Study on “Size and scope of economics at Vietnam hospitals in 2004” by Weavera and Deolalikar from Washington and California University, United State showed the large difference in the average cost among central hospitals, province hospitals and district hospitals (1.8 million USD; 0.5 million USD; and 83,182 USD respectively) (Flessa & Dung, 2004; Weaver & Deolalikar, 2004).

***Studies on determining the cost of prevention and intervention activities:***

Minh et al. (2007) showed the annual total cost of providing the expanded program on immunization at BaVi district was 58 460 USD. Vaccine and consumable supplies accounted for the largest proportion (33%), then the personal cost (30,2%). The highest rate for the cost of activities was at commune health station (38%). The average cost per vaccinated child was 4.81 USD - lower than the cost-effectiveness threshold of developing countries (15 USD)(Minh et al., 2008).



### 3.4. Studies on cost determinants of health services

Although it was necessary to determine the factors influencing to unit costs for purpose of improving the technical efficiency, a few studies explored it.

Breyer had been conducted a literature review of hospital cost function in 1986. The author mentioned that in the traditional cost function, in order to explain the variations of hospital output, the dependent variable had been used in most studies was “unit cost” instead of “total cost” to avoid the error terms because of heteroscedasticity in the regression analysis. Besides, “cost per inpatient services” was preferred than “cost per outpatient services” because it could be used as a proxy of hospital services (including nursing and accommodation) (Breyer, 1987)

In 2003, Adam, Evans and Muray carried out an study to explore the difference in unit cost of bed-day among countries, using OLS regression analysis. The independent variables were chosen based on economic theory and the available of data. The results found that an increase in GDP per capita were associated with an increase in cost per bed-day while occupancy rate has a negative relationship with unit cost of bed-day. The unit cost of bed-day in a tertiary level hospital with drug cost included was higher than the cost of bed-day in a primary level hospital with drug cost excluded. By contrast, it was not significant difference between primary level hospital and tertiary level for food cost. This study also showed that the cost per bed-day at level-1 hospitals and level-2 hospitals was lower than the cost at level-3 hospitals. However, there was insignificant difference among facility ownership and public not-for-profit hospitals (Adam et al., 2003).

Anderson (1980) conducted a cost function study at public general hospitals in Kenya. He aimed to specify a model of operational unit cost of Kenya government hospitals. The OLS technique was applied with the

dependent variable was average cost per patient day. He found that a growth in actual bed-day and set-up bed-day was associated with a decrease in the average cost per bed-day. Occupancy rate for actual bed-day and set-up bed-day also had a negative relationship with the unit costs of bed-day. An increase in total outpatient per inpatient day was associated with an increase in unit cost. The more number of subsidiary health institutions, the higher unit cost. The average cost per bed-day in a provincial hospital was higher than in non-provincial hospital. Opposite to the result of Adam et al.(2003), the study by Anderson indicated that an increase in average length of stay led to a reduction in cost per bed-day, but it was insignificant (Anderson, 1980).

## **Conclusion**

In Vietnam, the literature review showed that many studies on estimation cost of clinical services have been done before in view of provider perspective, using the top-down approach. However, firstly, studies were conducted on a small scale with 1 to 3 hospitals or just focused on a few specific diseases (e.g. diabetics). The purpose of these studies only focuses on providing information for hospital managers rather than policy makers. It was also difficult to compare the cost of using services among hospitals or among provinces which could provide more information for the development of regional adjustment coefficients in the allocation of funding. Secondly, there has been no study providing the database for determining base rate as well as aiming to be used for negotiating the payment rates with purchasers in process of performing the pilot capitation project in Bac Ninh, Ninh Binh, Thua Thien Hue and Khanh Hoa province. Thirdly, a few studies explore the determinants of the unit cost of inpatient services; however there has been no published study in Vietnam. Finally, although some authors found the fee schedule is lower than the actual cost of providing health services, however, defining the difference between actual costs and the newest fee schedule which has been

took effect in June 2017 is necessary for policy-makers in reforming payment mechanisms.



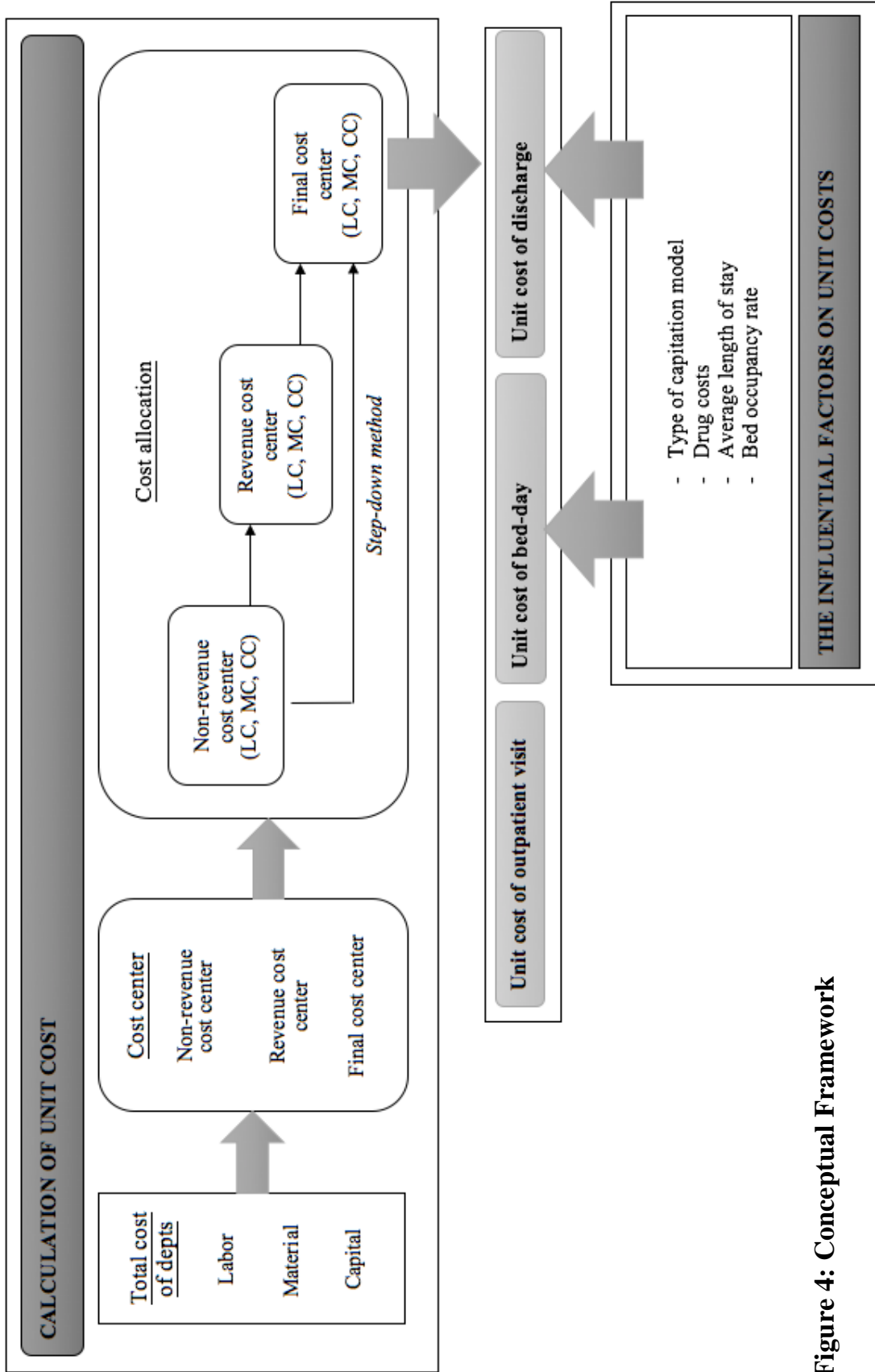
## **CHAPTER 4**

### **RESEARCH METHODOLOGY**

#### **4.1. Conceptual framework**

There are two parts which will analysis in this study. For part one, the exact unit cost calculation for health services depends largely on the "correct" allocation of both direct and indirect costs of the provider. The top-down approach using the step-down cost accounting technique will be applied in this study. The full costs comprise of direct and indirect cost will be assigned to all cost centres. These cost centres are classified by its functions, including administrative departments (non-revenue production cost centre), para-clinical departments (revenue production cost centre), and clinical departments (final cost centre). Direct costs such as drugs and supplies can be directly attributed to the cost of health services being created. Indirect costs, including management salary and auxiliary activities such as security can be allocated base on some criteria. After that, the full costs of all cost centre will be allocated to other cost centre by using step-down method (The detail in costing approach part). The unit cost of outpatient visit, bed-day and discharge are calculated by dividing the total cost of each final cost centre by the output indicators (e.g. number of outpatient visits, number of inpatient days, or number of beds, etc.).

For part two, all health facilities are included in an ordinary least squares regression analysis to explore the degree of association between unit cost of inpatient services (dependent variable) and collected hospital characteristics (explanatory variables). There are two models to determine the relationship between the unit cost of discharge and bed-day and factors, including “type of capitation model”, “average length of stay”, “bed occupancy rate” and “drug cost”



**Figure 4: Conceptual Framework**

#### **4.2. Study Perspective**

The provider perspective which will be employed in this study, concern about all relevant costs when delivering services, including expenditure from state budget, health insurance fund, and service charges.

#### **4.3. Study orientation**

A facility-based costing study will be conducted retrospectively, looking backward to estimate costs that had already occurred in the calendar year 2014 - the first year implementing the pilot project at four provinces. Due to this orientation, the study will use completely secondary data on service provision and financing activities which has been collected by Health Strategy and Policy Institute from January 2015 to June 2015. The data are constructed from aggregate data, using hospital information system from accounting and statistics.

#### **4.4. Time period**

One-year of data from the calendar year 2014 collected for some reasons. Firstly, this was the first year implementing the pilot project at 4 provinces. Secondly, it ensured to have adequate data on operation as well as financing at the time of data collection. Finally, annual data is collected as this is how facilities report on expenditures and utilization data and it evens reduces seasonal fluctuations in utilization which may impact to costs.

#### **4.5. Dataset**

The study is use completely secondary data on utilization, service provision and financing activities within 33 health facilities which has been collected by HSPI in the research project titled “Determining the cost of health services at health facilities implementing the project for the revision of the capitation payment mechanism in Vietnam”.

Researchers from HSPI trained local staffs from planning depts., finance depts. and pharmaceuticals for collecting data. These staffs were provided with a detailed manual for reference during the work process. After training, the selected staffs at each facility collected and entered the data on the computer. Finally, HSPI's researchers had responsibility for monitoring, checking and verifying the accuracy of data by comparing those data among difference departments.

The collected costing data cover seven cost components: (1) staff salaries and allowances, (2) medicines, (3) medical supplies and consumables medicines, (4) operations (water, electricity, etc.) and minor repair/maintenance, (5) training/research; (6) building; and (7) medical and non-medical equipment.

One workbook which was used for data collection at each district public facility, involved 9 sheets for general information, utilization, revenue, personnel, drugs, recurrent expenditures, building, medical equipment, and non-medical equipment. The details of data as illustrated table 4. However, because of Government is the sole purchaser of preventive health care, the health services delivered through the preventive health program, nationally targeted health programs at district health centres did not include in processing of data collection.

**Table 4: The details of data at each district public facility**

	<b>Description</b>	<b>Note</b>
<b>General information</b>	<ul style="list-style-type: none"> <li>- Name of facility</li> <li>- Type of facility</li> <li>- The population of catchment area</li> <li>- Total number of health insurance card</li> <li>- Total revenue by source of funds</li> </ul>	

	<ul style="list-style-type: none"> <li>- Number of staffs</li> <li>- Number of planned beds</li> </ul>	
<b>Utilization</b>	<ul style="list-style-type: none"> <li>- Number of outpatient visits, inpatient-day, discharges, procedures, surgery (type 1, 2, and 3), test and examination (clinical and para-clinical services), blood units, referrals.</li> <li>- Value of: prescriptions, consumables</li> </ul>	<ul style="list-style-type: none"> <li>- Separated by departments (depend on organizational structures.)</li> <li>- Separated by source of funds.</li> </ul>
<b>Revenue</b>	<ul style="list-style-type: none"> <li>- Total revenues from outpatient visits, inpatient-bed, surgery, test, medicines, medical supplies and consumables, referral services and other fees (foods, parking services, etc)</li> </ul>	<ul style="list-style-type: none"> <li>- Separated by departments (depend on organizational structures.</li> </ul>
<b>Personnel</b>	<ul style="list-style-type: none"> <li>- Staff annual revenues embraces salaries, allowances as professional hazard/risk payments, overtime, and incentive bonuses.</li> <li>- % of time that each staff spent to each department at facility.</li> </ul>	<ul style="list-style-type: none"> <li>- % of time separated by IPD and OPD for clinical department.</li> </ul>
<b>Drugs</b>	<ul style="list-style-type: none"> <li>- Total drug expenditures used directly at each clinical department.</li> </ul>	<ul style="list-style-type: none"> <li>- Separated by source of funds.</li> </ul>
<b>Recurrent expenditure</b>	<ul style="list-style-type: none"> <li>- Total expenditures for personnel: salaries and allowances, overtime, incentives and others.</li> <li>- Total expenditures for drugs, blood and supplies.</li> <li>- Total expenditures for operation: electricity, water supply, garbage disposal, gasoline</li> </ul>	<ul style="list-style-type: none"> <li>- Separated by source of funds.</li> </ul>



	<p>vehicles, laundry, food, stationary, taxes and other fees, minor repairing and maintenance.</p> <p>- Total expenditures for training and research: meetings and conferences, study tours, training and scientific research.</p>	
<p><b>Capital cost: building, medical equipment and non-medical equipment</b></p>	<ul style="list-style-type: none"> <li>• Building/infrastructure: name, year of construction, construction cost, areas, major renovation (time and cost)</li> <li>• Medical and non-medical equipment: code of equipment (model), the quantity, prices, years of operation</li> </ul>	<p>- Separated for each clinical and para-clinical department.</p>

*Source: District hospital costing questionnaire (HSPI-2014)*

#### 4.6. Data analysis

##### 4.6.1. Costing analysis

##### Costing approach

The “top-down” approach will be used to calculate the unit costs of outpatient and inpatient services of the health facilities. Regarding the approach, initially, the costs of each department were gathered and then allocated step-by-step to the departments by using step-down method. Based on the organizational structure of the hospital, the hospital determined different departments and divided into direct and indirect cost centers. Basically, the first cost center allocated costs to other centers and then to the final one. The direct cost centers perform costs collected directly from patients (all clinical and para-clinical departments) while the indirect centers process other indirect costs (e.g.

administration, laundry, etc.). The costs of the next service cost center are then accumulated and allocated in the same way. This process was re-performing step-by-step until all service cost centers were assigned to the final cost centers. Finally, unit costs are determined by dividing the total cost of each final cost center by the output indicators (e.g. number of outpatient visits, number of inpatient days, or number of beds, etc.).

### **Allocation of costs**

Step-down method is employed for allocating the costs of department. According to this method, both revenue and non-revenue centres are allocated by non-revenue centers step-by-step. There are 7 distinctive steps in processing of accounting (Conteh & Walker, 2004).

**Table 5: Steps in processing of calculation**

<b>Step</b>	<b>Description</b>
<b>1</b>	Define the final product
<b>2</b>	Identified departments are assigned to cost centers groups: <ul style="list-style-type: none"> <li>- Administrative departments</li> <li>- Para-clinical departments</li> <li>- Clinical departments</li> </ul>
<b>3</b>	Determining the list of cost items/ inputs and calculate total cost for those items
<b>4</b>	Direct costs are assigned to cost centers based on the actual data on the cost of items used.
<b>5</b>	Indirect costs are allocated based on an estimate of each department's share of the total cost for that cost items.
<b>6</b>	Allocation of totals costs from higher-level to lower-level cost centers: <ul style="list-style-type: none"> <li>- Both direct and indirect costs of administrative department are allocated to Para-clinical departments and clinical department.</li> <li>- Costs of para-clinical department, including the direct, indirect and allocated administrative department costs are</li> </ul>

	allocated to clinical department.
7	Calculation the unit costs

Source: (Conteh & Walker, 2004).

**Step 1: Define the final product which depends on policy objective and costing exercise purpose.**

This study is providing the data base as a starting point for informing payment rates to reform capitation payment mechanism. Hence, total 33 public district health facilities applying pilot capitation need to be calculated unit cost of outpatient visit, bed-day and discharge. As mentioned in literature review, computing a single unit cost for all outpatient services and all inpatient services for each health facility will be sufficient. For outpatient service, the final output is cost per outpatient visit. For inpatient services, the final output is cost per discharge and cost per bed-day. Cost per discharge means cost of a treatment session while cost per bed-day is cost of a day in hospital.

**Step 2: Identified departments at each health facility are assigned to cost centres groups**

For purpose of allocation the costs correctly, a range of cost centres has to be identified. Normally, there are three cost centres and its group based on their functional role within a health facility. These groups comprise of (1) Administrative departments (indirect cost centre) which provide overhead support services to other department; (2) Paraclinical departments (intermediate cost centre) which provide clinical support such as tests, imaging services, etc. to clinical departments; and (3) Clinical departments (direct cost centre) which provide direct care to patient with units of services are outpatient visit, discharges and bed-days. As a result, the departments will be classifying into cost centres as follows:

**Table 6: Cost centre groups**

<b>Administrative Dept.</b>	<b>Paraclinical Dept.</b>	<b>Clinical Dept.</b>
Administrative Organization	& Laboratory	General outpatient
Planning equipment	and Imaging Services	Emergency and Intensive care
Financing	Infection Control	Internal Medicine
Nursing	Pharmacy	Infectious Disease
	Nutrition	Paediatrics
	Operating theatre	Surgery
		Maternity/ Gynaecology
		ENT/Dental/ Ophthalmology
		Traditional Medicine
		Inter-Commune clinic

For clinical departments, exception of general outpatient is providing the outpatient services and inter-commune clinic providing both of outpatient and inpatient services, the rest of departments providing the inpatient service. The patients go to outpatient department first, and then transfer to inpatient departments if necessary.

### **Step 3: Determining the list of cost items/ inputs and calculate total cost for those items**

After assigning all departments to cost centres group, making a list of items used and its cost is the next step. All relevant costs when delivering services, including the revenues and expenditure from state budget, health insurance fund, and service charges are concern from the provider perspective.

The full cost includes labour costs, material cost and capitals costs. The labour costs comprise of personnel and scientific research. The material costs comprise of drugs and medical supplies, utilities, and maintenance. The capital cost composes of building, medical and non-medical equipment depreciation. The details of cost items indicate in the table below.

**Table 7: List of cost categories and cost items**

	<b>Cost category</b>	<b>Cost item</b>
<b>1</b>	<b>Labor Cost</b>	
	<p><i>Personnel:</i> The cost of wages paid to all staffs at a health facility, including temporary, contract and permanent personnel.</p>	<ul style="list-style-type: none"> <li>- Salaries</li> <li>- Benefits and allowances</li> <li>- Overtime</li> <li>- Incentives and bonuses</li> <li>- Others (Vacation, field trip, party, etc.)</li> </ul>
	<p><i>Training and scientific research</i> The cost of training and scientific research</p>	<ul style="list-style-type: none"> <li>- Training</li> <li>- Research</li> </ul>
<b>2</b>	<b>Material cost</b>	
	<p><i>Drugs and Medical Supplies/ Consumables:</i> The cost of all drugs and medical supplies used in patient care</p>	<ul style="list-style-type: none"> <li>- Drug</li> <li>- Blood products</li> <li>- Medical supplies/consumables</li> <li>- Diagnostic supplies/consumables</li> <li>- Lab reagents</li> <li>- Oxygen</li> <li>- Intravenous fluids</li> <li>- Others (Vaccines, etc.)</li> </ul>
	<p><i>Utilities:</i> The cost of utilities and other recurrent inputs consumed by a facility</p>	<ul style="list-style-type: none"> <li>- Electricity</li> <li>- Water</li> <li>- Waste treatment</li> <li>- Fuel and Oil</li> <li>- Linens</li> <li>- Patient Food</li> <li>- Office Supplies</li> </ul>

	<i>Maintenance</i> The maintenance cost of building and equipment	- Minor repairs/ maintenance
<b>3</b>	<b>Capital cost</b>	
	<i>Building</i> The total cost of building depreciation	- Building construction - Building renovation
	<i>Medical equipment</i> The total cost of medical asset depreciation	- Medical equipment - Surgical equipment - Diagnostic equipment
	<i>Non-medical equipment</i> The total cost of non-medical asset depreciation	- Computers - Air conditioners - Vehicles - Furniture - Washing machine - Refrigerator

Depreciated cost of durable assets, including building, medical equipment and non-medical equipment is estimated as following:

$$\text{Current value in 2014} = \text{Purchase value in year } t \times (1+r)^{2014-t}$$

$$\text{Annual capital cost} = \frac{\text{Present value in 2014}}{\text{Annualising factor}}$$

$$\text{Annualising factor} = \frac{1 - \text{Discount factor}}{r}$$

$$\text{Discount factor} = \frac{1}{(1+r)^n}$$

$$\rightarrow \text{Annual capital cost} = \frac{\text{Present value in 2014}}{\frac{1 - (1+r)^{-n}}{r}}$$

$r$  = discount or interest rate 3% (a standard discount rate recommend by the WHO)

$n$  = Useful life (years), the useful life of buildings, medical and non-medical equipment is applied according to the regulations issued by the Vietnamese Ministry of Finance in 2014

In order to comparing costs among different years, all costs are adjusted to the basis year (2014), using the Consumer Price Index (CPI) calculated by the Vietnam General Statistics Office ([www.gso.gov.vn](http://www.gso.gov.vn)).

#### **Step 4: Direct costs are assigned to cost centres based on the actual data on the cost of items used**

Some costs can be assigned to cost centres immediately based on the actual data on using of those cost items at each department which collected from District hospital costing questionnaire.

The cost of drug, medical supplies as well as the depreciated cost of medical equipment and non-medical equipment will be directly assigned to each department.

#### **Step 5: Indirect costs are allocated based on an estimate of each department's share of the total cost for that cost items.**

There are some costs that cannot be assigned to specific departments directly. These costs are considered indirect costs, which need to be allocated based on a proxy measure of a department's use of the resource. For health workers who maybe have many tasks across different departments, the personnel cost including the salaries, wages, benefit can be allocated based on the percentage of time the staff spending for each department. The measurement of square meter in floor area is the proxy for consumption of electricity, water or other overheads cost of each department. The measurement

of other recurrent cost such as maintenance, offices supplies, and so on can be based on number of personnel. However, for those health facilities where provide information inadequately about infrastructure and its square meter as well, the study will use regulation about design standard of a district hospital issued by MOH.

**Table 8: Cost item and allocation rules to cost centers**

<b>Cost item</b>	<b>Allocation rule</b>
<b>Personnel:</b> Salaries, Benefits and allowances, Overtime, Incentives and bonuses, Others	the percentage of time spending for each department
<b>Utilities</b>	
- Electricity	Square meter
- Water	Square meter
- Cleaning, sanitation	Square meter
- Transportation	Number of personnel
- Linens	Number of inpatient days
- Patient Food	Number of inpatient days
- Office Supplies	Number of personnel
<b>Minor repairs/ maintenance</b>	Square meter
<b>Building depreciation</b>	Square meter

#### **Step 6: Allocation of totals costs from higher-level to lower-level cost centres**

The next step is allocating costs from higher-level to lower-level cost centers. In the other word, allocating from less direct patient care (Administrative departments) to more direct patient care (Clinical departments). The method requires that the sum of each cost centre filters down to the remaining centres until one is left with the direct cost centres of interest.



**Table 9: Allocation rules of Administrative departments**

<b>Administrative department</b>	<b>Allocation rule</b>
Administrative & Organization	Number of personnel
Planning and equipment	Number of personnel
Financing	Number of personnel
Nursing	Number of inpatient days

**Table 10: Allocation rules of Para-clinical departments**

<b>Administrative department</b>	<b>Allocation rule</b>
Laboratory	Number of tests
Imaging Services	Number of imaging services
Infection Control	Number of inpatient days
Pharmacy	Value of prescriptions
Nutrition	Number of inpatient days
Operating theatre	Number of surgeries

**Step 7: Calculation the unit costs**

After allocation the cost of the department by using the step-down method, unit cost will be calculated. The unit costs include (1) cost per outpatient visit, (2) cost per -day, and (3) cost per discharge in each department of a district hospital. In principle, all clinical services provided by district hospitals/district health centres will be included in the cost analysis.

Unit cost per outpatient visit is calculated by dividing the total cost of medical examination department (including the direct costs of this Dept. and the indirect costs that are allocated from the supporting Dept. and non-clinical Dept.) by the total number of visits.

Unit cost per discharge is calculated by dividing the total cost of all Dept. providing inpatient services (including the direct costs of clinical dept. and the indirect costs that are allocated from the supporting Dept. and non-clinical Dept.) by the total number of discharge.

Unit cost per bed-day is calculated by dividing the total cost of all Dept. providing inpatient services (including the direct costs of clinical Dept. and the indirect costs that are allocated from supporting Dept. and non-clinical Dept.) by the total number of inpatient days.

### Sensitive analysis

Sensitivity analysis was also conducted to capture the uncertainty of the analyses as well as to examine changes after making to inputs which based on the different assumptions. This study used the changing of capital cost to five percent and seven percent to examine changes of the average full costs and average unit cost of outpatient visit, inpatient bed-day and discharge at all health facilities.

**Table 11: The dummy table of sensitive analysis**

	Full cost	Dif.	OPD visit	Dif.	Discharge	Dif.	Bed-day	Dif.
Base line 3%								
Discount rate 5%								
Discount rate 7%								

#### 4.6.2. Contributing factors analysis

##### Analysis strategic

According to the literature review, in this study, to identify the potential factors influencing to the unit cost of inpatient services (including bed-day and discharge), I proposed linear regression model as these variable was continuous variable. Totally, 33 health facilities will be included in an ordinary least squares regression analysis. The most importance factor determined the choice of explanatory variables is based on previous studies (Adam et al., 2003; Anderson, 1980). There were some key determinants, including “GDP”, “type of health facility”, “average length of stay”, “bed occupancy rate”, “drug cost”.

“GDP” variable has been used in the study by Adam et al. (2003) as a proxy for technology level. However, all health facilities in this study are 3-level hospital, applying same the technique list. Therefore, this variable was not included in the regression analysis.

“Type of hospital” has been used in studies by Anderson (1980) and Adam, Evans and Muray (2003). In Anderson’s study, the dummy variable for provincial hospital (compare to non-provincial). In Adam’s study, the dummy variables for hospital levels 1–2 (compare to level 3 hospitals). In my study, there are two kinds of health facilities, including hospital and health center. However, this study will be using “capitation model” variable instead of “type of health facility” variable because of two reasons. Firstly, there are two capitation models in the pilot project, in which model 1 apply both of capitation and FFS while model 2 apply only capitation. The unit cost of model 1 whether or not is higher than model 2 due to the affecting of FFS method. Secondly, the “capitation model” variable is not difference “type of health facility” variable because Bac Ninh and Ninh Binh province with hospital model are applying the capitation with outpatient only while Thua Thien Hue and Khanh Hoa provine with health center model are applying the capitation with both of outpatient and inpatient services.

Adam (2003) has examined the difference in the unit cost of bed-day between tertiary level hospitals with drug cost included and primary level hospitals with drug cost excluded. As mentioned in several study, drug cost accounted for a large proportion in the total cost. Thus, in this study, although all health facilities are providing drug, I still would like to explore the association between drug cost and cost of inpatient services. In other words, an increase in drug cost whether or not lead to an increase in the unit cost of inpatient visit.

“Bed occupancy rate (BOR)” has been used in studies by Adam (2003) and Anderson (1980). Both of studies explored the negative relationship

between BOR and unit cost of inpatient services. BOR is also included in this study as a proxy for utilization capacity level.

It was opposite result in study by Adam (2003) and Anderson (1980) about the association between “average length of stay” and unit cost of inpatient services. For Anderson’s study, the relationship was negative, however the difference was insignificant. This independent variable is available in this study, hence it also used in the OLS regression.

In summary, the explanatory variables in this study include (i) type of capitation model; (ii) drug cost; (iii) bed occupancy rate; and (iv) average length of stay.

**Table 12: Expected Sign of Coefficients**

<b>Independent Variable</b>	<b>Variable descriptions</b>	<b>Expected sign</b>	<b>Explain</b>
<b>Model</b>	The dummy variable of capitation model with outpatient only	-	Due to affecting of FFS method for inpatients services in model 1, the unit cost of inpatient services at health facilities applying the capitation model 1 with outpatient only is higher than the others.
<b>ALOS</b>	Average length of stay (days)	+	An increase in ALOS is associated with an increase in unit cost of inpatient services
<b>Drug cost</b>	Value of medicine (VND)	+	An increase in drug cost is associated with an increase in unit cost of inpatient services
<b>BOR</b>	Bed occupancy rate	-	An increase in occupancy rate is associated with a reduction in unit cost of inpatient services

The bivariate linear regression analysis was conducted to explore the potential factors associated with the dependent variable of interest, which

informed the variables included in multivariate linear regression analysis. Correlations among all continuous variables can also be obtained to examine for any collinearity issues in the dataset.

There are two OLS models:

***The first model:***

*Dependent variable:* unit cost of discharge

*Explanatory variable:* Type of capitation model, Drug cost, Average length of stay, bed occupancy rate

$$Y1 = \beta_0 + \beta_1 * \text{MODEL} + \beta_2 * \text{DRUG} + \beta_3 * \text{ALOS} + \beta_4 * \text{BOR}$$

***The second model:***

*Dependent variable:* unit cost of bed-day

*Explanatory variable:* Type of capitation model, Drug cost, Average length of stay, bed occupancy rate

$$Y2 = \beta_0 + \beta_1 * \text{MODEL} + \beta_2 * \text{DRUG} + \beta_3 * \text{ALOS} + \beta_4 * \text{BOR}$$

## **CHAPTER 5**

### **RESULTS**

#### **5.1. Background information**

##### **5.1.1. Study site**

The original data were collected from four provinces of Vietnam, namely Bac Ninh, Ninh Binh, Thua Thien Hue, and Khanh Hoa.

Bac Ninh, the province with the smallest area in Viet Nam, which located in the Red River Delta region and the Northern key economic region. The province has one city, one town, and six districts. There are 126 commune-level units, including 23 urban wards, six towns, and 97 communes.

Ninh Binh located in shared area of three regions (Northwest, Red River Delta and North Central Coast). The province, which encompasses two cities and six districts, has 146 commune-level units (121 communes, 17 wards, and seven towns).

Thua Thieu Hue is the centre of North Central Coast region of Vietnam. There are six districts, two towns and a city in the province. It has 152 commune-level units, including eight towns, 39 wards, and 105 communes.

Khanh Hoa is a province of South-Central Coast region. Regarding administrative organization, the province has two cities, one town, and six districts, which was divided into 35 wards, six towns, and 99 communes.

##### **5.1.2. The implementation of the piloting project on capitation-based provider payment for health service**

In 2014, the project was piloted in Bac Ninh with seven district hospitals and one city health centre under health insurance scheme. The number of

health insurance cards registered in these health facilities were 633,119, which was 12.6% higher than the corresponding figure in 2013. Ninh Binh had 13 health facilities contracting to implement capitation-based health services provision, of which there were seven district hospitals, one city health centre, one police hospital, and one military health station, and three private clinics. The number of insured people was 635,701, accounting for 68.5% of the population by 2015. Thua Thien Hue had eight district health centres and one city health centres participating the project. The number of the enrollees was 914,471 peoples or 81% of the population. Khanh Hoa conducted the pilot in two city health centres, one town health centre, and two district health centres. The population covered by health insurance was 64% in 2014.

**Table 13: The health insurance coverage in four piloting provinces, 2014**

<b>Bac Ninh</b>	<b>Ninh Binh</b>	<b>Thua Thien Hue</b>	<b>Khanh Hoa</b>
75%	68.5%	81%	64%

Capitation payment method is defined as a fixed amount of money per an insured person in a certain period based on the predefined ranges of services provided in a specific health facility. There were two different models of the pilots. Model 1 was to apply the capitation method for only outpatient services provided in the district-level facilities under the health insurance scheme. For model 2, both outpatient and inpatient services were covered by the payment scheme. Capitation fund is amount of money allocated for a health facility by the provincial social security agency based on the number of enrollees and pre-determined rates of payment (The formula of calculating the capitation fund as presented in previous section). The actual payment is the patient's treatment cost which is paid by the provincial social security agency. Fund balance is calculated by the total allocated capitation fund minus actual payment.

The model-1 pilot was conducted in Bac Ninh and Ninh Binh. Although 81% of the collected health insurance fund was allocated to the selected health facilities in these two provinces (90% as planned), the surplus fund balance

was achieved in both two provinces in 2014. In detail, all of eight facilities in Bac Ninh had the surpluses with 19.4 billion VND in total while there were 11 facilities with fund surplus (9.8 billion VND), and two facilities with fund deficit (862 million VND) in Ninh Binh.

Thua Thien Hue and Khanh Hoa implemented the model-2 project. The allocated fund was 90% of the total collected fund as planned. After the implementation, Thua Thien Hue had a deficit of their capitation fund (7.3 billion VND) whereas Khanh Hoa had the total surplus of 6.6 billion VND.

**Table 14: The fund balance sheet in 2014 in four piloting provinces, in VND**

No.	Provinces	Allocated fund in 2014	Actual payment in 2014	Fund balance
<b>Model 1: Capitation-based outpatient services</b>				
1	Bac Ninh	117,917,249,500	98,546,130,690	19,371,118,810
2	Ninh Binh	59,503,926,154	49,707,968,615	9,795,957,539
<b>Model 2: Capitation-based outpatient and inpatient services</b>				
3	Thua Thien Hue	87,967,354,422	95,305,079,375	-7,337,724,953
4	Khanh Hoa	114,939,475,843	108,355,939,472	6,583,536,371

In the principle of designing the capitation payment, base rate must be calculated based on the actual cost of medical services. However, due to lacking of costing exercises, all calculating formulas in designing the pilot project for both of two models still use the historical data of paying the health services covered by health insurance. This method leads to difficulties in balancing the fund, and thus influences to the decision of hospital managers in applying the capitation payment. The details are explained in discussion chapter.



## 5.2. Background characteristics of the health facilities

As the data collection was not conducted in a police hospital, a military health station and three private clinics in Ninh Binh, the costing study was performed in 33 out of 38 health facilities involving in the piloting project in four provinces. This section presents basic characteristics of 33 health facilities selected for the study.

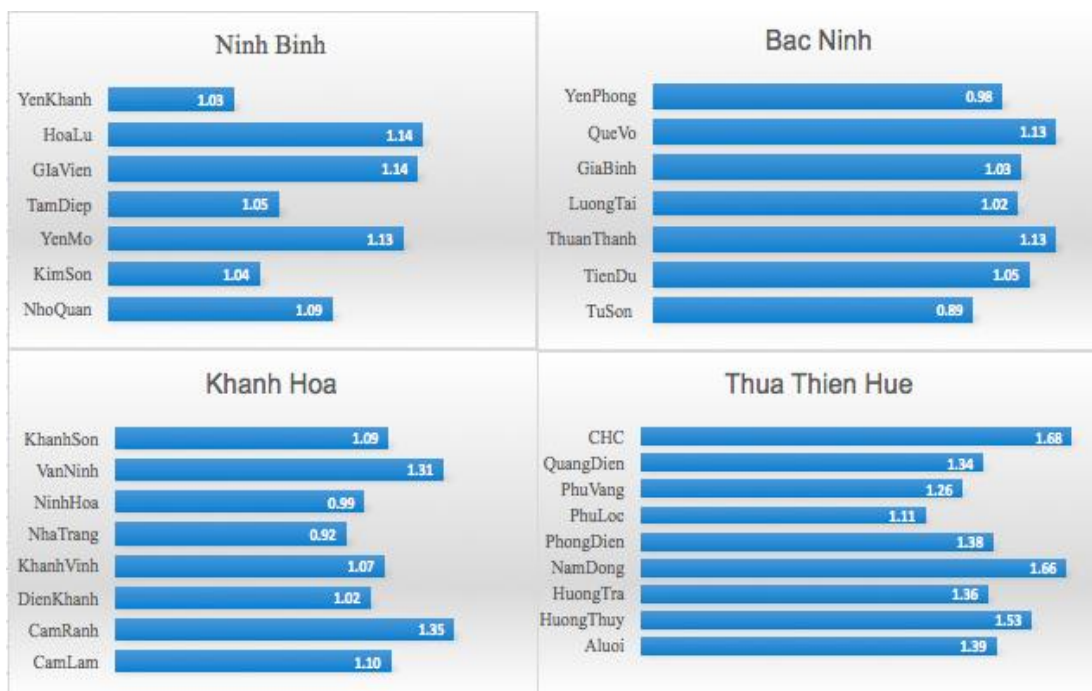
**Table 15: The basic characteristics of the health facilities**

No.	Health facility	Population	Insurance card	No of bed	No of staff	No of Depts.
<b>Bac Ninh province</b>						
1.	Yen Phong DH	n/a	n/a	120	117	20
2.	Que Vo DH	n/a	n/a	120	135	15
3.	Gia Binh DH	n/a	n/a	110	113	16
4.	Luong Tai DH	113,457	66,019	112	114	20
5.	Thuan Thanh DH	154,960	91,683	120	135	21
6.	Tien Du DH	145,307	88,372	120	126	16
7.	Tu Son DH	n/a	n/a	150	134	13
8.	Bac Ninh CHC	178,000	151,300	0	43	9
<b>Ninh Binh province</b>						
9.	Gia Vien DH	n/a	n/a	80	87	20
10.	Hoa Lu DH	68,750	45,000	70	73	18
11.	Kim Son DH	175,642	92,182	145	164	19
12.	Nho Quan DH	n/a	n/a	165	174	19
13.	Yen Khanh DH	137,229	74,586	70	80	17
14.	Yen Mo DH	114,000	n/a	110	113	17
15.	Tam Diep DH	62,570	45,997	100	114	19
16.	Ninh Binh CHC	n/a	n/a	0	39	14
<b>Thua Thien Hue province</b>						
17.	A Luoi DHC	47,482	45,272	80	111	18
18.	Huong Thuy DHC	103,417	71,433	80	122	17
19.	Huong Tra DHC	123,308	77,541	90	122	18
20.	Nam Dong DHC	25,000	21,891	50	83	14
21.	Phong Dien DHC	103,329	71,037	80	110	19
22.	Phu Loc DHC	134,628	81,703	135	150	18
23.	Phu Vang DHC	188,101	124,676	90	113	20
24.	Quang Dien DHC	84,450	n/a	80	107	19

No.	Health facility	Population	Insurance card	No of bed	No of staff	No of Depts.
25.	Hue CHC	357,807	243,308	110	185	17
<b>Khanh Hoa province</b>						
26.	Cam Lam DHC	110,788	64,084	165	181	13
27.	Dien Khanh DHC	n/a	n/a	200	203	16
28.	Khanh Son DHC	n/a	20,833	80	87	15
29.	Khanh Vinh DHC	n/a	n/a	100	107	15
30.	Ninh Hoa DHC	238,802	126,714	140	139	13
31.	Van Ninh DHC	134,938	68,364	170	222	15
32.	Cam Ranh CHC	128,000	85,760	20	27	8
33.	Nha Trang CHC	414,205	269,000	125	115	9

The coverage of health insurance was over 50% in all the districts. Especially, Bac Ninh city (Bac Ninh), Tam Diep city (Ninh Binh), A Luoi District, and Nam Dong and Nam Dong (Thua Thie Hue) had the proportion of insured population of more than 70%.

The size of hospital beds ranged from 110 to 150 in Bac Ninh, 70 to 165 in Ninh Binh, 50 to 135 in Thua Thien Hue, and 80 to 200 in Khanh Hoa (excepting Cam Ranh health centre with a substantially small number of hospital beds). As shown in table 13, the more the number of hospital bed, the higher number of personnel. Figure 5 indicates that there were differences in the number of health staff per bed between the hospitals within a province and across provinces.



**Figure 5: The number of health staff per hospital bed in all the selected hospitals**

Regarding the organizational structure, there was a difference among hospitals/health centres. The facilities varied in types and quantity of their departments, which were not fully identical with the standard regulated by the Ministry of Health. The number of departments of the health facilities ranged from 13 to 15. There were several reasons for this discrepancy, including (i) the combination of departments; (ii) some inter-departments separating into stand-alone specialized departments, e.g. Department of Dentistry-ENT-Ophthalmology; (iii) combination of Internal Medicine and Traditional Medicine Departments; and (iv) some facilities separated Intensive Care Units (ICU) Department and Poisoning Control Department. Appendix 1 illustrates the organizational structure of the hospitals against the guideline issued by the MOH.

### 5.3. Health service provision in the health facilities

The information on health service provision was gathered from the Department of General Planning in each hospital. Although all of the facilities were class-3 hospitals, the figures on service delivery considerably varied between the facilities in 2014.

**Table 16 : Number of services provided at each health facility, in VND**

No.	Health Facility	No of OP	No of Discharge	No of Bed-day	ALOS	No of test	No of Imaging
<b>Bac Ninh Province</b>							
1.	Tu Son DH	153,567	11,231	53,089	4.7	499,533	90,811
2.	Tien Du DH	89,140	8,164	53,392	6.5	251,122	75,643
3.	Thuan Thanh DH	109,870	9,922	46,808	4.7	481,416	102,202
4.	Luong Tai DH	67,975	5,869	30,593	5.2	61,782	68,044
5.	Gia Binh DH	117,248	7,459	39,444	5.3	62,932	49,165
6.	Que Vo DH	108,312	9,062	47,748	5.3	269,477	58,957
7.	Yen Phong DH	97,379	10,422	50,965	4.9	121,463	46,855
8.	Bac Ninh CHC	57,031	-	-	-	80,869	19,599
	<b>Average</b>	<b>100,065</b>	<b>8,876</b>	<b>46,006</b>	<b>5.2</b>	<b>198,486</b>	<b>57,522</b>
<b>Ninh Binh Province</b>							
9.	Gia Vien DH	61,922	5,117	33,698	6.6	44,644	12,031
10.	Hoa Lu DH	31,144	3,285	16,425	5.0	37,548	9,287
11.	Kim Son DH	76,825	14,680	64,497	4.4	104,295	25,513
12.	Nho Quan DH	80,305	14,073	74,945	5.3	108,658	55,374
13.	Tam Diep DH	69,989	8,868	48,774	5.5	111,418	45,852
14.	Yen Khanh DH	66,741	10,461	78,856	7.5	129,270	28,272
15.	Yen Mo DH	75,975	11,476	69,140	6.0	103,402	36,668
16.	Ninh Binh	36,521	-	-	-	6,179	10,836

No.	Health Facility	No of OP	No of Discharge	No of Bed-day	ALOS	No of test	No of Imaging
	CHC						
	<b>Average</b>	<b>62,428</b>	<b>9,709</b>	<b>55,191</b>	<b>5.8</b>	<b>80,677</b>	<b>27,979</b>
	<b>Thua Thien Hue Province</b>						
17.	A Luoi DHC	23,450	6,800	31,192	4.6	22,340	16,634
18.	Huong Thuy DHC	57,017	6,573	29,656	4.5	42,673	18,734
19.	Huong Tra DHC	64,543	5,772	35,955	6.2	21,221	19,317
20.	Nam Dong DHC	13,955	2,927	18,184	6.2	4,110	3,322
21.	Phong Dien DHC	40,167	5,094	28,588	5.6	10,768	19,789
22.	Phu Loc DHC	89,731	10,590	62,088	5.9	35,189	25,105
23.	Phu Vang DHC	55,523	9,659	52,154	5.4	56,024	35,417
24.	Quang Dien DHC	37,032	4,763	31,804	6.7	28,363	19,646
25.	Hue CHC	168,137	7,628	46,149	6.0	39,084	10,688
	<b>Average</b>	<b>61,062</b>	<b>6,645</b>	<b>37,308</b>	<b>5.7</b>	<b>28,864</b>	<b>18,739</b>
	<b>Khanh Hoa Province</b>						
26.	Cam Lam DHC	85,235	12,011	46,778	3.9	59,867	56,496
27.	Cam Ranh DHC	25,327	1,661	5,119	3.1	8,274	6,903
28.	Dien Khanh DHC	273,189	20,107	105,793	5.3	178,049	36,212
29.	Khanh Vinh DHC	24,824	7,023	35,509	5.1	15,404	4,384
30.	Nha Trang DHC	317,669	3,964	21,201	5.3	117,331	24,154
31.	Ninh Hoa DHC	143,354	12,370	59,870	4.8	272,936	9,490
32.	Van Ninh CHC	103,905	16,444	65,595	4.0	80,888	24,183
33.	Khanh Son CHC	33,036	4,884	28,931	5.9	15,711	3,039
	<b>Average</b>	<b>125,817</b>	<b>9,808</b>	<b>46,100</b>	<b>4.7</b>	<b>93,558</b>	<b>20,608</b>

Regarding outpatient services, the average number of visits in Khanh Hoa was the highest with 125,817 visits, followed by Bac Ninh having 100,065 visits on average. Ninh Binh and Thua Thien Hue were relatively similar in the number of visits (62,428, and 61,062 visits, respectively). The city health centres had the lowest number of visits in Bac Ninh and Ninh Binh (57,031 and 36,521 visits, respectively) whereas, in Thua Thien Hue and Khanh Hoa, the city health centres were among the highest (168,137 and 317,669 visits, respectively). In Bac Ninh and Ninh Binh province, the level 2 hospitals (Bac Ninh general hospital and Ninh Binh general hospital) is not far from city health centres, hence the patients are easy to access and bypass as well. This is the reason why the number of outpatient visit at city health centres in Bac Ninh and Ninh Binh province is lower than in Thua Thien Hue and Khanh Hoa province.

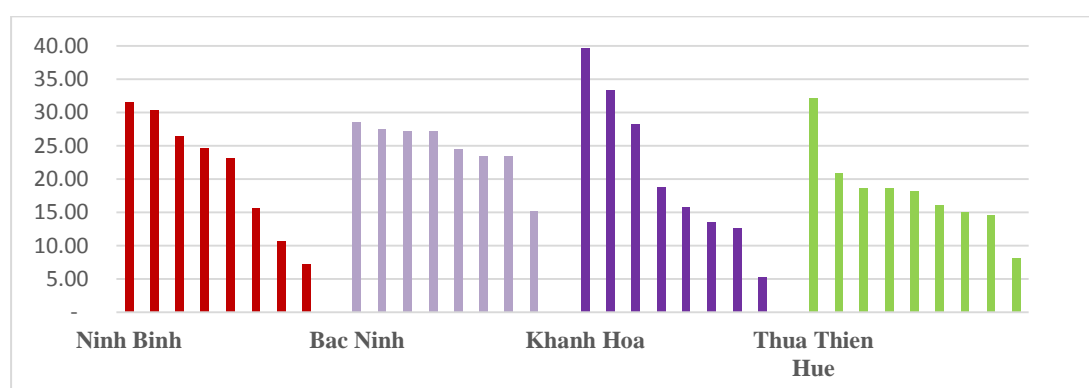
In terms of inpatient services, excepting Thua Thien Hue which have a considerably low utilization (6,645 discharge, on average), there was no significant difference in the number of hospital discharges among Khanh Hoa, Ninh Binh, and Bac Ninh (9,808; 9,709; and 8,876 discharge, respectively). The higher number of discharges, the lower number of bed-day. It was the case in our data as the number of bed-day in Khanh Hoa were the lowest (4.7 days) while the corresponding number of Thua Thien Hue was quite high (5.7 days). Ninh Binh had the second largest number of discharge; the number of bed-day, however, was the highest (5.8 days). This might be due to the fact that three district hospital of Ninh Binh, namely, Yen Mo, Gia Vien, and Yen Khanh had the highest mean length of stay in the sample (6.0, 6.6, and 7.5 bed-day, respectively).

For the provision of para-clinical tests and imaging diagnoses, the average number of tests and imaging diagnosis were the highest in Bac Ninh and lowest in Thua Thien Hue. In Bac Ninh, Tu Son provided 499,533 tests, 90,811 imaging services and Thuan Thanh hospital provided 481,416 tests and

102,202 imaging services each in 2014. In Thua Thien Hue, Phu Vang district health centre appeared to have the greatest number of test and imaging services as 56,024 and 25,417, respectively. The type of capitation model in the pilot project can help to explain the difference in providing tests and imaging diagnoses between Bac Ninh and Thua Thien Hue. For inpatient services, Bac Ninh is applying the FFS mechanism while it is capitation one in Thua Thien Hue. Basically, health facilities may tend to limit the indication for service in the implementation of capitation method while they are more likely to increase the number of indications with fee-for-service methods.

#### 5.4. Financial management

Data on the recurrent expenditure were extracted from financial accounting and reporting system of the health facilities. The recurrent expenditures included (i) personnel (salary, allowance, bonuses, and etc); (ii) blood and medicines; (iii) Consumables; (iv) operational costs (electricity, water supply, telecommunication, etc.); (v) minor repairs and maintenance; (vi) research and training activities; and (vii) other expenses. It was found that there was the consistency between the health service provision and financial outputs among the health facilities.



**Figure 6: The recurrent expenditure of the health facilities in 2014**

*Unit: Billion VND*

In both of Bac Ninh and Thua Thien Hue, aside from city health centre, there was no remarkable difference among the health facilities. In Bac Ninh, five facilities spent around 27 billion VND (Tu Son, Thuan Thanh, Que Vo, Gia Binh, Yen Phong), the others' expenditure was more than 23 billion VND (Yen Phong, Luong Tai). In Thua Thien Hue, the current expenditure of health centres ranged from 14.6 to 20.8 billion VND. Nevertheless, there was a noticeable difference in the expenditure of city health centres between two provinces. While Bac Ninh city health centre has the lowest expenditure (15 billion VND), Hue city health centre was found to be the highest in the province (32.2 billion VND). As can be seen in the table 14 about the characteristic of health facilities, there were 43 health staffs with 9 departments in Bac Ninh city while these figures in Thua Thien Hue city were 185 and 17 respectively. Bac Ninh city only provided outpatient services while Thua Thien Hue city provided both of outpatient and inpatient services. In Thua Thien Hue city health centre was double compare to Bac Ninh city health centre.

On the other hand, the figures exhibit the significant disparity in the recurrent expenditure among the health facilities within a province in both Ninh Binh and Khanh Hoa. In Ninh Binh, two facilities with the highest expenditure were Nho Quan hospital and Kim Son hospital with approximately 40 billion VND each while Ninh Binh city health center with the lowest expenditure (7.2 billion). In Khanh Hoa, the population and the health insurance coverage in Nha Trang city was triple higher than Cam Ranh city in 2014 (table 14). As a result, the size of hospital bed and number of health staffs in Nha Trang city were five times higher than Cam Ranh city. Therefore, while Nha Trang city health centre spent 39.6 billion VND as the highest expenditure, only 5.2 billion VND, as the lowest, was spent by the Cam Ranh city health centre in 2014.



## **5.5. Unit cost of health services**

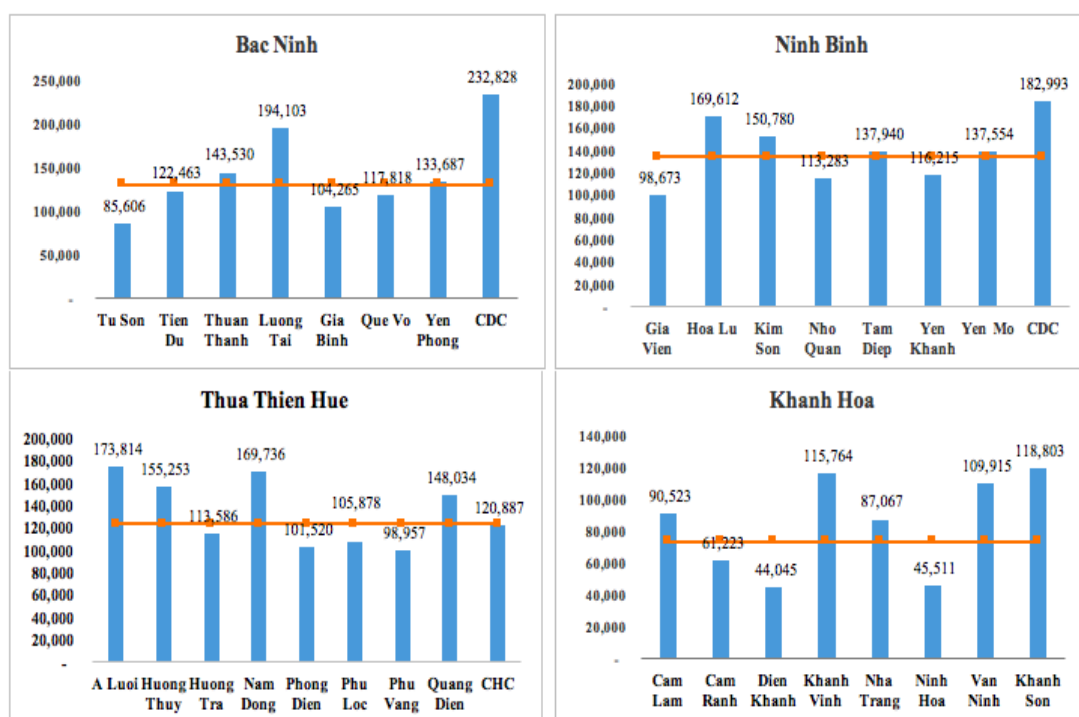
The main findings of the study are presented in this section. A single unit cost for all inpatient care and outpatient for each hospital were calculated. Due to the limitation of using secondary data, some health facilities were unable to provide sufficient data on infrastructure. Therefore, firstly, the costing exercise was calculated with five cost components, including (i) staff salaries and allowances, (ii) medicines, (iii) medical supplies and consumables, (iv) operations (water, electricity, etc.) and minor repair/maintenance and (v) training and research. As a result, the costing exercise was done with all of 33 health facilities involving this study, which provided a reasonable sample size to conduct further analysis on factors associated with the unit costs of an outpatient visit, an inpatient day, and a hospital discharge. Secondly, the costing exercise was calculated with seven cost components, in which two additional cost components were included (vi) building depreciation; (vii) health equipment depreciation. The costing exercise was only performed with 16 health facilities where provided inputs sufficiently for the calculation of asset depreciation. As used all of the cost components, it was possible to provide better information for hospital managers about the proportion of cost components.

### **5.5.1. Findings of five-component costing**

This section presents the outcomes of costing exercise with five cost components, including unit cost per outpatient visits, per discharge, and per inpatient day. For obtaining more reliable comparisons, the weighted average unit costs (WAUC) were calculated. WAUC was calculated by multiplying the total of the unit costs of each facility with the corresponding yearly number of outputs (e.g. number of visits) and then dividing by the total output numbers for the whole sample.

### 5.5.1.1. Outpatient cost

In four provinces, the overall WAUC per an outpatient visit was 109,000 VND. Excepting Khanh Hoa which had the lowest WAUC (73,222 VND), the WAUC of other three provinces ranged from 122,841 VND to 133,331 VND.



**Figure 7: Unit cost per outpatient visit at each health facility (5 components), in VND**

This difference in WAUC between Khanh Hoa and the other three provinces is possibly explained by the fact that Khanh Hoa had a considerably greater number of outpatient visits compared to the others. Nevertheless, although the mean number of visits Bac Ninh was higher than Ninh Binh and Thua Thien Hue, there was no discrepancy in the unit costs between these provinces. One of the possible reasons is that the health facilities in Bac Ninh provided a much higher number of tests and imaging services than the health

facilities in Ninh Binh as well as Thua Thien Hue which lead to increase the unit cost.

#### 5.5.1.2. Inpatient services

**Table 17: Unit cost of inpatient services at each health facility (5 components), in VND**

No.	Health facility	Total cost of inpatient services	Cost per discharge	Cost per bed-day
<b>Bac Ninh Province</b>				
1.	Tu Son DH	14,062,672,701	1,252,130	264,889
2.	Tien Du DH	12,495,715,843	1,530,587	234,037
3.	Thuan Thanh DH	11,675,196,946	1,176,698	249,427
4.	Luong Tai DH	10,280,407,698	1,751,783	336,038
5.	Gia Binh DH	12,277,586,396	1,646,010	311,266
6.	Que Vo DH	14,469,151,751	1,596,684	303,032
7.	Yen Phong DH	15,554,430,458	1,492,461	305,198
8.	Bac Ninh CHC	-	-	-
	<b>Weighted Average</b>		<b>1,461,730</b>	<b>282,001</b>
<b>Ninh Binh Province</b>				
9.	Gia Vien DH	9,480,663,628	1,852,778	281,342
10.	Hoa Lu DH	5,462,383,855	1,662,826	332,565
11.	Kim Son DH	20,110,281,419	1,221,949	278,125
12.	Nho Quan DH	22,381,109,198	1,590,358	298,634
13.	Tam Diep DH	9,654,253,779	1,520,393	276,435
14.	Yen Khanh DH	16,197,756,300	1,548,395	205,409
15.	Yen Mo DH	19,925,133,563	1,387,690	230,332
16.	Ninh Binh CHC	-	-	-
	<b>Weighted Average</b>		<b>1,484,228</b>	<b>261,090</b>

<b>Thua Thien Hue Province</b>				
<b>17.</b>	A Luoi DHC	10,974,612,063	1,613,914	351,841
<b>18.</b>	Huong Thuy DHC	7,052,213,853	1,072,906	237,801
<b>19.</b>	Huong Tra DHC	10,037,819,492	1,739,054	279,177
<b>20.</b>	Nam Dong DHC	5,772,005,002	1,971,987	317,422
<b>21.</b>	Phong Dien DHC	11,361,392,890	2,230,348	397,418
<b>22.</b>	Phu Loc DHC	11,332,667,256	1,070,177	182,526
<b>23.</b>	Phu Vang DHC	13,110,129,293	1,357,297	251,373
<b>24.</b>	Quang Dien DHC	13,283,531,813	1,881,346	281,752
<b>25.</b>	Hue CHC DHC	11,144,822,507	1,461,041	241,497
	<b>Weighted Average</b>		<b>1,487,105</b>	<b>267,286</b>
<b>Khanh Hoa Province</b>				
<b>26.</b>	Cam Lam DHC	10,740,357,993	894,210	229,603
<b>27.</b>	Cam Ranh CHC	2,641,645,925	1,590,395	516,047
<b>28.</b>	Dien Khanh DHC	20,460,236,311	1,017,568	193,399
<b>29.</b>	Khanh Vinh DHC	10,571,812,960	1,505,313	297,722
<b>30.</b>	Nha Trang CHC	7,428,656,788	1,874,030	350,392
<b>31.</b>	Ninh Hoa DHC	9,186,510,411	742,644	153,441
<b>32.</b>	Van Ninh DHC	16,374,836,679	995,794	249,635
<b>33.</b>	Khanh Son DHC	8,689,877,867	1,779,254	300,366
	<b>Weighted Average</b>		<b>1,097,241</b>	<b>233,446</b>

The analysis shows that the overall WAUC of a discharge and a bed day in four provinces were 1,366,000 VND and 260,000 VND, respectively. On average, the unit cost per discharge and inpatient bed-day ranged from 1,097,000 VND (US\$ 51.90) to 1,487,105 VND (US\$ 70.21), and 233,000 VND (US\$ 11.04) to 282,001 VND (US\$ 13.34) VND, respectively.

The number of discharges in Khanh Hoa, Bac Ninh, and Ninh Binh was identical; however, the WAUC of Khanh Hoa was significantly lower than the others. This may be due to the number of hospital days in Khanh Hoa (4.7 days) was the lowest among the provinces.

### 5.5.1.3. Cost components

The contribution of different cost components was illustrated in table 17. It can be seen that on average, cost components were difference among provinces. In Ninh Binh province, the labour cost and material cost were similar (10,6 billion VND and 10,2 billion VND respectively). The cost for personnel was lower than the cost for material in Bac Ninh and Khanh Hoa province while Thua Thien Hue province was the opposite.

**Table 18: Cost components at each facility (5 components)**

	<b>Health Facility</b>	<b>Labor cost</b>	<b>Material cost</b>	<b>Full cost</b>
	<b>Ninh Binh Province</b>			
<b>1</b>	Gia Vien DH	9,613,797,894	5,976,870,424	15,590,668,318
<b>2</b>	Hoa Lu DH	6,754,156,485	2,941,754,382	9,695,910,867
<b>3</b>	Kim Son DH	16,253,095,971	13,268,811,416	29,521,907,386
<b>4</b>	Nho Quan DH	17,465,217,478	14,013,045,627	31,478,263,105
<b>5</b>	Tam Diep DH	10,933,335,032	12,203,762,719	23,137,097,751
<b>6</b>	Yen Khanh DH	10,013,514,968	14,663,919,074	24,677,434,042
<b>7</b>	Yen Mo DH	10,134,743,108	16,241,022,567	26,375,765,675
<b>8</b>	Ninh Binh CHC	3,853,206,696	3,053,958,353	6,907,165,049
	<b>Average</b>	<b>10,627,633,454</b>	<b>10,295,393,070</b>	<b>20,923,026,524</b>
	<b>Bac Ninh Province</b>			
<b>9</b>	Tu Son DH	12,947,304,831	14,261,664,215	27,208,969,046
<b>10</b>	Tien Du DH	10,450,500,785	12,961,571,277	23,412,072,062
<b>11</b>	Thuan Thanh DH	10,868,324,410	16,576,545,360	27,444,869,770
<b>12</b>	Luong Tai DH	9,296,200,400	14,178,360,015	23,474,560,415

<b>13</b>	Gia Binh DH	9,310,753,000	15,191,738,158	24,502,491,158
<b>14</b>	Que Vo DH	9,763,508,416	17,466,716,361	27,230,224,777
<b>15</b>	Yen Phong DH	12,553,058,402	16,019,645,975	28,572,704,377
<b>16</b>	Bac Ninh CHC	3,457,462,469	9,820,973,000	13,278,435,469
	<b>Average</b>	<b>9,830,889,089</b>	<b>14,559,651,795</b>	<b>24,390,540,884</b>
<b>Khanh Hoa Province</b>				
<b>17</b>	Cam Lam DHC	10,334,879,721	8,121,178,478	18,456,058,199
<b>18</b>	Cam Ranh CHC	2,512,464,677	1,679,780,840	4,192,245,517
<b>19</b>	Dien Khanh DHC	18,606,685,166	13,886,030,530	32,492,715,696
<b>20</b>	Khanh Vinh DHC	8,416,135,521	5,029,400,159	13,445,535,680
<b>21</b>	Nha Trang CHC	8,892,447,436	26,194,660,304	35,087,107,740
<b>22</b>	Ninh Hoa DHC	7,400,041,490	8,310,716,719	15,710,758,209
<b>23</b>	Van Ninh DHC	13,994,805,311	13,800,713,136	27,795,518,447
<b>24</b>	Khanh Son DHC	7,937,673,577	4,676,969,077	12,614,642,654
	<b>Average</b>	<b>9,761,891,612</b>	<b>10,212,431,155</b>	<b>19,974,322,768</b>
<b>Thua Thien Hue Province</b>				
<b>25</b>	A Luoi DHC	9,888,075,621	5,162,472,090	15,050,547,711
<b>26</b>	Huong Thuy DHC	10,060,203,830	5,844,085,193	15,904,289,023
<b>27</b>	Huong Tra DHC	8,998,368,503	8,370,647,352	17,369,015,855
<b>28</b>	Nam Dong DHC	5,352,050,749	2,788,614,057	8,140,664,806
<b>29</b>	Phong Dien DHC	9,878,171,507	5,560,981,644	15,439,153,151
<b>30</b>	Phu Loc DHC	12,883,812,615	7,949,388,862	20,833,201,477
<b>31</b>	Phu Vang DHC	12,024,980,279	6,579,563,460	18,604,543,739
<b>32</b>	Quang Dien DHC	10,333,510,323	4,109,354,180	14,442,864,503
<b>33</b>	Hue CHC	17,357,084,383	14,113,399,599	31,470,483,982
	<b>Average</b>	<b>10,752,917,535</b>	<b>6,719,834,049</b>	<b>17,472,751,583</b>

### 5.5.2. Findings of seven-component costing

This section presents the outcomes of costing exercise with seven cost components at health facilities where has provided data of building and equipment. They include Kim Son, Nho Quan, Yen Khanh, Yen Mo hospital in Ninh Binh; Tu Son, Thuan Thanh, Luong Tai hospital and Bac Ninh city health center in Bac Ninh; Cam Lam, Cam Ranh, Nha Trang, Van Ninh health center in Khanh Hoa; and Huong Thuy, Nam Dong, Quang Dien district health center and Hue city health center in Thua Thien Hue.

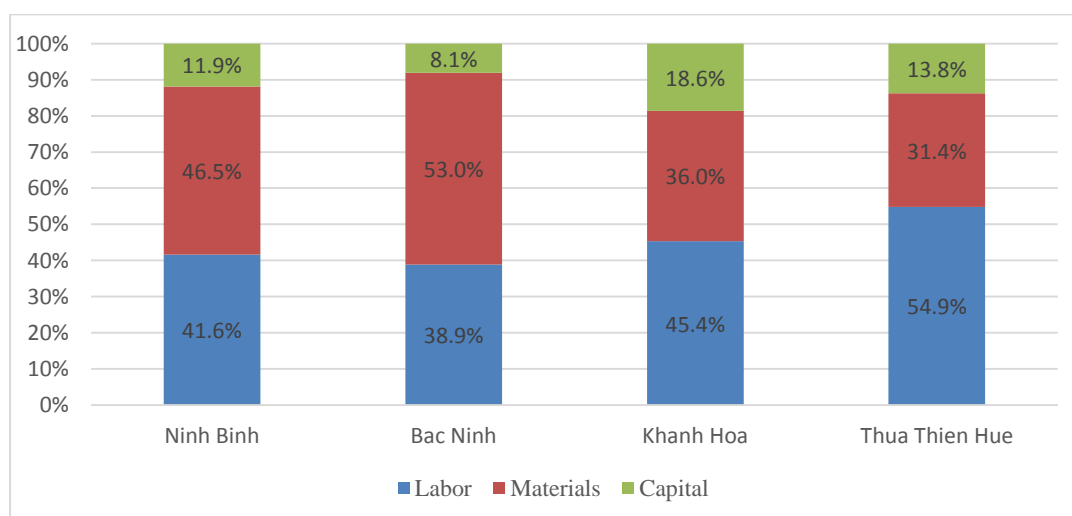
In four provinces, it was estimated that the WAUC per outpatient visit, per discharge, and per bed day were 131,000 VND, 313,000 VND, and 1,597,000 VND, respectively. On average, the unit cost per outpatient visit, inpatient bed-day, and discharge ranged from 97,000 VND to 160,000 VND, 292,000 VND to 357,000 VND and 1,452,000 VND to 1,779,000 VND, respectively.

**Table 19: Unit costs of key services at each health facility (7 components), in VND**

No.	Health Facility	Unit cost per Discharge	Unit cost per Bed-day	Unit cost per Outpatient visit
<b>Ninh Binh Province</b>				
1.	Kim Son DH	1,369,910	311,802	169,068
2.	Nho Quan DH	1,970,157	369,952	128,836
3.	Yen Khanh DH	1,678,491	222,668	119,402
4.	Yen Mo DH	1,629,107	270,402	156,323
	<b>Average</b>	<b>1,658,919</b>	<b>292,552</b>	<b>144,009</b>
<b>Bac Ninh Province</b>				
5.	Tu Son DH	1,365,318	288,834	88,155
6.	Thuan Thanh DH	1,437,174	304,641	148,847
7.	Luong Tai DH	1,951,165	374,285	207,764
8.	Bac Ninh CHC	-	-	318,983
	<b>Average</b>	<b>1,518,937</b>	<b>314,538</b>	<b>160,142</b>
<b>Khanh Hoa Province</b>				

9.	Cam Lam DHC	1,218,614	312,899	100,894
10.	Cam Ranh CHC	1,715,896	556,769	67,226
11.	Nha Trang CHC	2,305,976	431,154	87,351
12.	Van Ninh DHC	1,391,747	348,897	135,589
	<b>Average</b>	<b>1,452,865</b>	<b>357,002</b>	<b>97,982</b>
<b>Thua Thien Hue Province</b>				
13.	Huong Thuy DHC	1,279,220	283,528	167,431
14.	Nam Dong DHC	2,781,345	447,701	208,479
15.	Quang Dien DHC	2,218,644	332,266	163,325
16.	Hue CHC	1,550,952	256,358	125,230
	<b>Average</b>	<b>1,779,150</b>	<b>309,615</b>	<b>143,259</b>

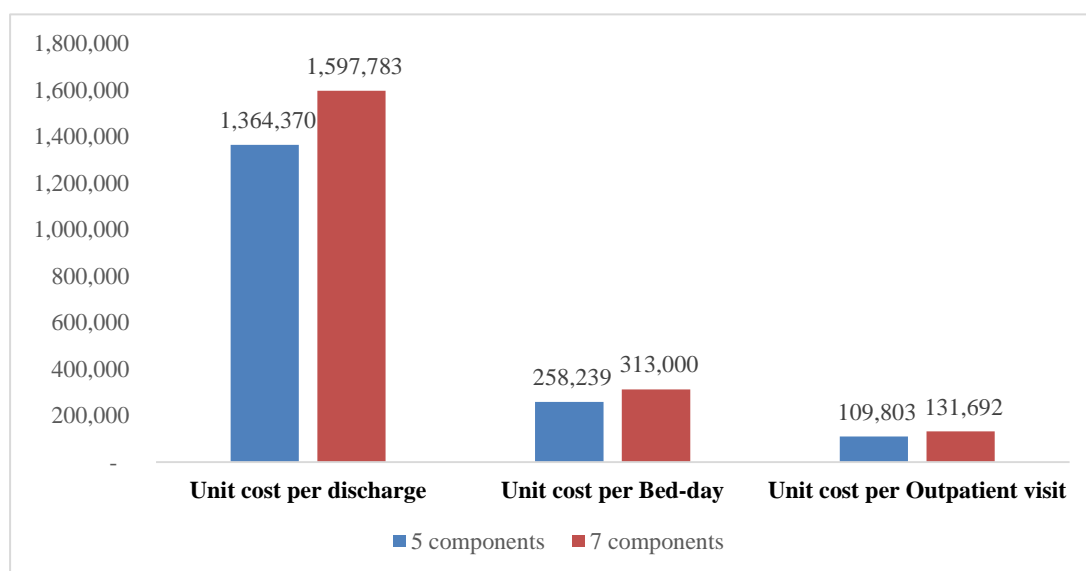
The figure 8 illustrates the cost components of the recurrent expenditure in each province. In Ninh Binh and Bac Ninh, the cost of materials accounted for the largest proportion, followed by labor cost. In contrast, labor costs had the greatest share of the total expenditure in Khanh Hoa and Thua Thien Hue. Capital costs accounted for the lowest proportion in all the provinces (8.1% to 18.6%).



**Figure 8: Contribution of cost components in total cost at each province**



Figure 9 exhibits the difference in unit costs between the two costing options. The costing exercise with seven components reveal 17% higher in the WAUC per discharge, and 15% higher in the WAUC per bed day and per visit than those of the 5-component option.



**Figure 9: The comparison in WAUCs between two costing options, in VND.**

Although the asset depreciation made up a low proportion, there was an considerable implication to the change in unit cost of outpatient visit, inpatient bed-day and discharge due to two additional cost components, including building depreciation and medical and non-medical equipment depreciation. The policy-makers need consider these factors in adjustment the fee schedule in coming years.

### **5.5.3. Comparison between the calculated unit cost of OP and IP services and the new fee schedule**

Table 20 shows a comparison between the calculated cost per outpatient visit on average in each province and the newly established fee schedule that

will take effect in June 2017. The unit cost of outpatient in this study at each province was found to be higher than the new fee level.

**Table 20: Comparison between the calculated unit cost of outpatient and the new fee schedule, in VND**

	<b>Actual unit cost (exclude capital)</b>	<b>Actual unit cost (include capital)</b>	<b>New Fee schedule (exclude capital)</b>
<b>Ninh Binh</b>	133,000	144,000	31,000
<b>Bac Ninh</b>	130,000	160,000	31,000
<b>Khanh Hoa</b>	73,000	98,000	31,000
<b>Thua Thien Hue</b>	122,000	143,000	31,000

Table 21 shows a comparison between the calculated cost per bed-day on average in each province and the latest fee. The unit cost of inpatient days in all departments at each province is higher than this new fee schedule.

**Table 21: Comparison between the calculated unit cost of inpatient day and the new fee schedule, in VND (exclude capital cost)**

<b>Clinical Department</b>	<b>Ninh Binh</b>	<b>Bac Ninh</b>	<b>Thua Thien Hue</b>	<b>Khanh Hoa</b>	<b>Fee schedule</b>
Emergency and intensive care	301,368	446,711	514,902	387,837	245,700
Internal Medicine	211,406	241,911	193,366	154,161	149,800
Paediatrics	203,302	161,485	187,455	138,076	149,800
Infectious Disease	355,960	368,384	240,047	181,796	149,800
Surgery	295,054	417,013	228,493	328,539	133,800
Maternity/ Gynaecology	291,468	327,058	259,491	325,327	133,800
ENT/Dental/Ophthalmology	372,686	318,512	261,469	197,604	133,800
Traditional Medicine	226,820	246,368	261,605	280,148	112,900
Inter-commune clinic	241,333	-	268,577	270,507	108,000

Even if capital cost was not included in comparison between the calculated unit cost of outpatient and inpatient bed-day and the latest fee

schedule, the results indicated that the fee level would not be able to ensure the cost recovery.

#### 5.5.4. Sensitivity analysis

The result of sensitivity analysis was shown in table 22 and 23. First, the average full cost and the average unit costs (OPD visit, discharge and bed-day) of providing health services was calculated with the discount rate three percent of asset depreciation, then changing of discount rate to five percent and seven percent. The cost difference was calculated by dividing the difference between the cost of scenario and the cost of baseline by the cost of scenario.

**Table 22: Sensitivity analysis results: Full cost**

		<b>Full cost</b>	<b>Cost difference</b>
<b>0</b>	Baseline	23,618,993,513	-
<b>1</b>	Discount rate 5%	26,684,148,015	0.114
<b>2</b>	Discount rate 7%	27,721,952,995	0.148

The full costs of health service provision increased 11.4% with five percent discount rate whilst this figure was 14.8% with seven percent discount rate.

**Table 23: Sensitivity analysis results: Unit cost of patient service**

	<b>OPD visit</b>	<b>Dif.</b>	<b>Discharge</b>	<b>Dif.</b>	<b>Bed-day</b>	<b>Dif.</b>
Baseline	150,666	-	1,716,510	-	340,855	-
Discount rate 5%	151,353	0.05	1,747,007	0.02	346,835	0.02
Discount rate 7%	153,681	0.02	1,801,784	0.05	357,532	0.05

The difference unit cost per outpatient visit ranged from 0.5% to 2%. The difference unit cost per inpatient services (including discharge and bed-day) ranged from 2% to 5%.

### 5.6. Contributing factors to unit costs

Table 24 shows the variable names, description, the mean and standard error of variables used in the regression analysis to examine the factors influencing the unit costs. The model variables were normally distributed.

**Table 24: Descriptive statistics of the variables used in the OLS regression analysis**

Variables	Descriptions	Mean	Standard error
Capitation model	The dummy variable of capitation model with outpatient only	0.5	0.51
uc_of_discharge	Unit cost of a hospital discharge (VND)	1,479,960	352,277.5
uc_of_bed	Unit cost of a bed day (VND)	274,310.2	54,521.7
alos	Average length of stay (days)	5.41	0.83
Drug costs	Value of medicine (VND in millions)	10,719.2	3,401.5
BOR	Bed occupancy rate	115.9	44.3

Table 25 and 26 presents the models of the OLS regression that were built to examine the level of association between each of individual unit costs hospital and explanatory variables (hospital characteristics).

**Table 25: The models of the OLS regression: cost per discharge**

<b>Adjusted R<sup>2</sup> = 0.47</b>	<b>F statistic = 7.69</b>		<b>P of F statistic</b>	
<b>Variable</b>	<b>Coefficient</b>	<b>Standard error</b>	<b>t</b>	<b>P</b>
Capitation Model	-106,536.6	95,371.2	-1.12	0.275
Bed occupancy rate	-4,375	1,383.1	-3.16	0.004
Average length of stay	327,511.4	73,535.5	4.45	0.000
Drug cost	-12.9	15.6	-0.83	0.415

For hospital discharges, the observation of Cam Ranh, Ninh Binh and Bac Ninh city health center was removed from the analysis because the unit cost Cam Ranh health facility appeared as an outlier as well as an influential point in model building steps while Ninh Binh and Bac Ninh health facility did not provide the inpatient services. The results show that the average length of stay ( $p < 0.001$ ) and bed occupancy rate ( $p < 0.01$ ) appeared to have significant associations with the unit cost of a discharge. The model can explain 47% of the variability in the unit cost of a hospital discharge. An increase in 1% occupancy rate results in a reduction in the unit cost of 4,375 VND whereas an additional day of hospital stay results in an increase in the unit cost of 327,511 VND. The table indicated that the cost per discharge at health facility applying capitation for only outpatient services was 106,537 VND higher than the unit cost of the which piloted capitation method for both outpatient and inpatient services, however, it was insignificant. For drug cost, although insignificant, it was astonishing that an increase in drug cost led to a reduction in unit cost per discharge.

**Table 26: The models of the OLS regression: cost per bed-day**

<b>Adjusted R<sup>2</sup> = 0.23</b>	<b>F statistic = 3.16</b>		<b>P of F statistic</b>	
<b>Variable</b>	<b>Coefficient</b>	<b>Standard error</b>	<b>t</b>	<b>P</b>
Capitation Model	-22,146.4	17,960.2	-1.23	0.229
Bed occupancy rate	-746.1	260.5	-2.86	0.008
Average length of stay	12,927.7	13,848.1	0.93	0.359
Drug cost	-2.06	2.9	-0.70	0.488

For the regression model of inpatient days, similar to model of discharge, the observation of Cam Ranh, Ninh Binh and Bac Ninh city health center was also removed from the analysis. The result showed the occupancy rate was the only significant predictor of the unit cost per bed day. The model was able to explain 23% of the unit cost. The model indicates that the increase in occupancy rate is associated with a reduction in the unit cost per inpatient day by 746 VND. There were no significant difference between capitation model, drug cost, average length of stay and cost per bed-day.

## CHAPTER 6

### DISCUSSION AND CONCLUSION

This chapter composes of conclusion of study, discussion of the result, recommendation and limitation of study

#### **6.1. Conclusion**

This study focus on cost analysis at 33 district public health facilities applying two pilot capitation models in four provinces of Vietnam by using the secondary data since January 1, 2014 to December 31, 2014. The specific objectives include (1) to calculate a unit cost of all outpatient services and inpatient services at each health facilities in four provinces in the calendar year 2014; (2) to determine the contribution of different cost components (including labour cost, material cost and capital cost) in total costs of study health facilities; (3) to calculate the difference between the unit cost of outpatient visit and inpatient days and the new fee schedule that took effect in June 2017; and (4) to explore the determinants to the unit cost of inpatient bed-day and discharge.

The “top-down” approach was applied to calculate the unit costs in selected health facilities from providers’ perspective. Regarding the approach, the costs of each department were gathered and then allocated to other departments by using the step-down method. For exploring the determinants of unit costs, an ordinary least squares regression analysis is employed.

Findings from five-components costing exercise showed that on average, the unit cost per outpatient visit, inpatient bed-day and discharge in four provinces ranged from 73,000 VND (US\$3.45) to 133,000 VND (US\$ 6.29); 233,000 VND (US\$ 11.04) to 282,001 VND (US\$ 13.34) and 1,097,000 VND (US\$ 51.90) to 1,487,105 VND (US\$ 70.21), respectively. The unit costs of a bed day were similar among the provinces while the cost per an outpatient

visit and a hospital discharge were various. Particular, Khanh Hoa has lower unit costs compared with the others because Khanh Hoa has the highest number of visit and discharge and the lowest average length of stay.

Findings from seven-components costing exercise showed that on average, the unit cost per outpatient visit, inpatient bed-day, and discharge ranged from 97,000 VND to 160,000 VND, 292,000 VND to 357,000 VND and 1,452,000 VND to 1,779,000 VND, respectively. The cost of materials accounted for the largest proportion, followed by labor cost in Ninh Binh and Bac Ninh. In contrast, labor costs had the greatest share of the total expenditure in Khanh Hoa and Thua Thien Hue.

In this study, the unit cost of outpatient visit and the unit cost of inpatient days in all departments at each province was found to be higher than the latest fee schedule which that took effect in June 2017.

For cost determinants, studies showed that factors such as the average length of stay and bed occupancy rate contribute significantly to the difference in the unit cost of inpatient services. In particular, for hospital discharges, an increase in occupancy rate results in a reduction in the unit cost whereas an additional day of hospital stay results in an increase in the unit cost. For hospital days, the increase in the occupancy rate was associated with the reduction in the unit cost per inpatient day. The capitation dummy is not significant, in other words, there is no difference in unit cost of inpatient services in facilities that pilot the capitation for outpatient services relative to those that pilot capitation for inpatient and outpatient services.

Including a total of 33 public district health facilities, this study is the most extensive cost assessment of unit costs for outpatient visits, inpatient days and discharges in Vietnam thus far. Therefore, firstly, the results of calculation the unit cost of outpatient and inpatient services are going to provide to technique group of pilot project as a starting point for calculating the payment rates and negotiating with the purchaser in the process of reforming the



provider payment mechanisms in Vietnam. Secondly, the results of comparison between the actual cost and the fee schedule help to provide better information for policymakers in developing accurate and adequate hospital fee schedule in the coming years. Finally, the detailed costing exercise is sent to hospital managers as a financial management tool to run health facilities more efficient.

## **6.2. Discussion**

### **6.2.1. The implementation of the piloting project**

The capitation model-1 pilot was conducted in Bac Ninh and Ninh Binh while Thua Thien Hue and Khanh Hoa implemented the capitation model-2 project. After one year of the implementation, excepting Thua Thien Hue had a deficit of their capitation fund (the total treatment cost of insured patients was higher the total allocated capitation fund), the surplus fund balance was achieved in other provinces in 2014. By applying the capitation for both of outpatient and inpatient services with a ceiling payment which has been regulated in the pilot project, the model 2 might shift more risk to the providers than model 1 that apply capitation for only outpatient services.

Pilot health facilities must balance their own surplus or deficit. It is clear there is no protection mechanism for these pilot facilities and this is one of the major constraints in implementing the revised capitation model. Although the guidelines have been agreed and showed clearly that pilot health facilities can use the surplus fund, in practice they can only use up to 20% while 80% will be kept in the reserve fund. In addition, all formulas of calculation the capitation fund as well as base rate are based on historical data and the last budget plan. Thus, for the surplus health facilities, this calculation method will lead to a reduction of their allocated capitation fund in the coming year. They are the reasons why whether the health facilities are deficit or surplus, they are reluctant to continue applying the capitation mechanism. As a result, in order to create the incentive to hospital managers in applying capitation mechanism, it

is necessary to identify the base rate and total capitation fund as well base on the actual cost of providing health services. This study will provide the results of calculating the unit costs of outpatient visit, inpatient bed-day and discharge as a starting point in this process.

### **6.2.2. Unit cost of outpatient and inpatient services**

It was found that the results of this study show differences and similarities in comparison with what has been published in the prior costing studies in Vietnam.

#### ***The difference in the result of calculation the unit costs***

##### ***Comparison the cost figures among studies***

In 2007, the result of a study conducted in a district hospital in the North of Vietnam found that the cost of an outpatient visit ranged from US\$ 0.27 and US\$ 0.65, and the cost of a bed-day was from US\$ 0.81 to US\$ 2.62 (Flessa & Dung, 2004). In 2007, another study found that the cost of an outpatient visit and an inpatient day in a district hospital were US\$ 0.21-0.43 and US\$ 2.31-6, respectively (Mediconsult Vietnam, 2007). In a recent study, the unit cost of an outpatient visit was US\$0.40-0.65, the cost per inpatient day was US\$ 1.84-7.66 (Minh et al., 2010).

**Table 27: Comparison of cost figures among studies, in \$US**

<b>Service</b>	<b>This study</b>	<b>Steffen Flessa, 2004</b>	<b>Mediconsul, 2007</b>	<b>Minh HV, 2010</b>
<b>Type of health facility</b>	- 14 District hospitals - 14 District health centres - 5 City health centres	- 1 District hospital	- 1 District hospital	- 3 District hospitals
<b>OP visit</b>	3.45 – 6.29	0.27 – 0.65	0.21 – 0.43	0.40 – 0.65
<b>Inpatient day</b>	11.04 – 13.34	0.81 – 2.62	2.31 – 6.45	1.84 – 7.66

There are several reasons for the difference in comparison with other studies. Firstly, hospitals at different technical level or even at the same level have various measures of allocating resources within the hospital, which varies the cost results as well as the utilization rate. Van Minh et al. comments that cost estimated can be influenced by different factors, for example, patient case mix, the scale of the study, the definition of costs, costing approaches, cost components used, availability and quality of data, the effect of inflation, etc (Minh et al., 2010). Secondly, the salary of staffs at each time is not similar due to the changes in government regulation which impact to the unit cost. Moreover, the hospital staffs at the pilot facilities showed the average increasing of drug and other consumable supplies price as well as medical services price in 2014 was 3% and 5% respectively.

#### *Comparison the cost figures among provinces*

In this study, as we compared the cost of the same services provided by different health facilities at the same time and by using the same costing method, it allows us to discuss further on efficiency issues. The cost per a bed

day was quite similar among the provinces while the cost of an outpatient and discharge were various. Particularly, these costs of Khanh Hoa were significantly lower than the others. Assuming that there was no difference in the quality of service among the provinces, the lowest cost in Khanh Hoa may imply that their hospital performed more efficiently than the others' hospitals. For outpatient visit, this difference in unit cost between Khanh Hoa and the other three provinces is possibly explained by the fact that Khanh Hoa had a considerably greater number of outpatient visits compared to the others. For discharge, although the number of discharges in Khanh Hoa, Bac Ninh, and Ninh Binh was identical, the average length of bed in Khanh Hoa province was the lowest among the provinces which can reduce the unit cost.

### ***Cost components***

Most of studies conducted in Vietnam and other countries shows that human resources had the largest share of the total cost (Chatterjee et al., 2013; Chuc & Phuong, 2002; Hammad et al., 2016; Minh et al., 2010; Minh et al., 2015; Olukoga, 2007; Prinja et al., 2016; Younis et al., 2013). However, it is inconsistent with what were found in this study. The costing exercise with five-components, it can be seen that cost components were difference among provinces. In Ninh Binh province, the labour cost and material cost were similar (10,6 billion VND and 10,2 billion VND respectively). The cost for personnel was lower than the cost for material in Bac Ninh and Khanh Hoa province while Thua Thien Hue province was the opposite. As shown in the figure 5, the number of health staffs per hospital bed in all the health centres in Thua Thien Hue was higher than the other provinces. It was the reason which lead to personnel cost in Thua Thien Hue province accounted for a higher proportion compare to material cost. On average, the labor : material costs ratio of four provinces is 50 : 50. The costing exercise with seven-components reveal 17% higher in the WAUC per discharge, and 15% higher in the WAUC

per bed day and per visit than those of the 5-component option. The cost of materials accounted for the largest proportion, followed by labor cost in Ninh Binh and Bac Ninh while Khanh Hoa and Thua Thien Hue in the opposite view. On average, the labor : material : capital costs ratio of four provinces is 41 : 46 : 13. The changing of cost component proportion can be due to the increasing of drug and other consumable supplies price as well as medical services price in 2014 (3% and 5% respectively). In fact, in Southeast Asia, Vietnam is one of the strongest growing pharmaceutical markets. In BMI's report, the value of Vietnam pharmaceutical market in 2013, 2014 and 2015 is US\$3.3 billion, US\$3.9 billion and US\$4.2 billion, respectively. The growth rate of Vietnam pharmaceutical market in the period 2010-2015 is 17-20%. The forecast of drug consumption per capita is US\$40 in the coming years<sup>4</sup>. Regarding the wage setting, in Vietnam, the minimum wage (base salary) applies to civil servants and employees who is working in the agencies, organizations. Table 28 shows the regulation of base salary from 2012 to 2016. In many years ago, the annually increasing average of base salary had been 19%; however this number decreased in recent years to below 10%(Thanh, Trinh, & Tung, 2016).

**Table 28: The minimum wage from 2012 to 2013, in VND**

<b>Time of application</b>	<b>The minimum wage</b>	<b>Increasing rate</b>
<b>May 1<sup>st</sup>, 2012</b>	1,050,000	26.5
<b>July 1<sup>st</sup>, 2013</b>	1,150,000	9.5
<b>May 1<sup>st</sup>, 2016</b>	1,210,000	5.2
<b>July 1<sup>st</sup>, 2017</b>	1,300,000	7.4

<sup>4</sup> Workshop “Vietnam Pharmaceutical Industry and Opportunities from Policy Change”

### ***Comparison the actual cost and the latest fee schedule***

The unit cost of outpatient services and inpatient services in this study at each province was found to be higher than the new fee level, for both of costing exercise with five-components (exclude capital cost) and costing exercise with seven-components (include capital cost). This finding is similar with some studies which has carried out in both of Vietnam and other countries (Chuc & Phuong, 2002; Minh et al., 2010). In fact, in Vietnam, fee schedule firstly was estimated by selected central hospital, and then was adjusted by experts instead in using of costing exercise. It is the key reason of gap in cost. Besides, the latest fee schedule is calculated based on five components instead of seven components. In this study, the result of calculation the cost component proportion indicated that capital cost makes up 13% in the total cost. The policy maker can use this finding as a reference in developing accurate and adequate hospital fee schedule in the coming years.

#### **6.2.3. Contributing factors to unit costs**

Our study indicates that the unit costs of the hospitals can be influenced by the hospital's characteristics. Regarding the piloting project, Bac Ninh and Ninh Binh applied the capitation method for only outpatient services and the fee-for-service method for inpatient while both the payment for outpatient and inpatient services were employed the method in Khanh Hoa and Thua Thien Hue. As noted in the literature, health facilities tended to limit the indication for service to secure their allocated fund in the implementation of capitation method while they are more likely to increase the number of indications with fee-for-service methods. Therefore, before analyzing data, I assume there is no difference in unit cost of outpatient visit among models while the unit cost of inpatient service in Bac Ninh and Ninh Binh will be higher than Thua Thien

Hue and Khanh Hoa. However, the results showed there are no significant differences in unit cost of inpatient services.

For inpatient services, an increase of occupancy rate results in a reduction in the unit cost. This finding is similar to previous studies (Adam et al., 2003; Anderson, 1980). The average bed occupancy rate at all study health facilities is 116%. In the other word, Vietnamese government hospitals generally operate beyond planned capacity. As can be seen that the health facilities are increasing the rate of utilizations as a way to solve the increasing in demands of inpatient services. In fact, two or more patients usually share one bed; even some of them must to sleep on the lobby of hospitals. It leads to a reduction in the cost due to some problems in the quality of caring and treatment as well.

For hospital discharges, an additional day of hospital stay results in an increase in the unit cost of 327,511 VND. This finding is consistent with study by Adam (2003) (Adam et al., 2003; Anderson, 1980). One possible explanation is along with an additional day, the costs toward caring and treatment patients are also increasing, including: human resource, laboratory and X-ray services, drug and consumable, etc.

### **6.3. Recommendation**

The identification of the payment rate of health insurance services in developing provider payment methods, regardless of capitation, the fee for services, or diagnosis-related group, should be based on the costing of health services. Besides, the calculation of cost coefficients in determining payment rates of health service should be based on the costing study with a sufficiently big sample size. Thus, the costing exercise should regularly be conducted in order to monitor, supervise, and assess the efficiency of a health facility. It is necessary to develop strategies and plans to reformulate the health information

and reporting system of the hospital to manage patient-level and department-level data.

#### **6.4. Limitation**

There are several limitations in using secondary data in this study. Firstly, the health services delivered through the preventive health program, nationally targeted health programs at district health centers did not include in the processing of data collection. Secondly, because of unavailability of data, the cost of land and donated items were excluded. Thirdly, the difference in organization structure of health facilities led to the difficulties in analyzing and comparing the results of unit costs. Fourthly, as the difficulty in providing adequately the information needed of building, medical and non-medical equipment, there are only 16 over 33 health facilities that were calculated the outcomes of costing exercise with seven cost components. Fifthly, by using accounting cost, the study just focused on the actual money spent on the resource, in other words, the opportunity cost was ignored. Finally, there was a very small number of observations for regression analysis; hence it was only indicative results.



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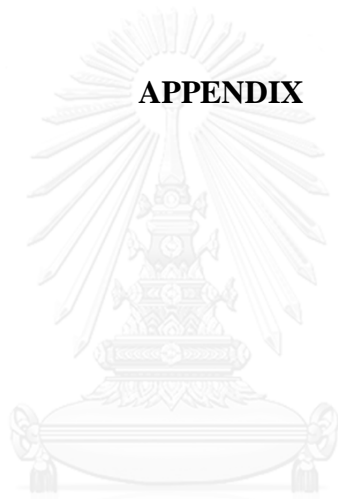
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**APPENDIX**



จุฬาลงกรณ์มหาวิทยาลัย  
CHULALONGKORN UNIVERSITY

**Table 29: Organization structure of 8 BacNinh district health facilities compared to the MOH regulation on hospital organization**

MOH regulation	<u>YenPhong</u>	<u>QueVo</u>	<u>GiaBinh</u>	<u>LuongTai</u>	<u>ThuanThanh</u>	<u>TienDu</u>	<u>TuSon</u>	<u>BacNinh</u>
<b>Supporting Department</b>								
Administrative & Organization	√	√	√	√	√	√	√	++
Planning and equipment	√	√	√	√	√	√	√	√
Financing	√	√	√	√	√	√	√	√
Nursing	√	√	√	√	√	√	√	-
						Management		
<b>Para-clinical Department</b>								
Laboratory	√	√	√	√	√	√	√	√
Imaging Services	√	+	√	+	+	√	√	√
Pathology	-	-	-	-	-	-	-	-
Infection Control	-	-	-	-	-	-	-	-
Pharmacy	√	√	√	√	√	√	√	√
Nutrition	-	-	-	-	-	-	-	-
	Operating theater	Operating theater	Operating theater	Operating theater	Operating theater	Operating theater	Operating theater	Operating theater
<b>Clinical Department</b>								
General outpatient	√	√	√	√	√	√	√	√
Emergency and Intensive care	√	-	√	√	√	√	√	
Internal Medicine	√	++	++	++	√	++	++	-
Infectious Disease	√				√			-

MOH regulation	<u>YenPhong</u>	<u>QueVo</u>	<u>GiaBinh</u>	<u>LuongTai</u>	<u>ThuanThanh</u>	<u>TienDu</u>	<u>TuSon</u>	<u>BacNinh</u>
<u>Pediatrics</u>	√		√	√	√	√		-
<u>ENT/Dental/Ophthalmology</u>	√	√	√	√	+	√	++	-
<u>Surgery</u>	√	√	√	√	√	++		-
<u>Maternity/ Gynecology</u>	√	√	√	√	√		√	-
<u>Traditional Medicine</u>	√	√	√	√	√	√	√	√
		Inter-commune clinic		Inter-commune clinic				
								Dept. of hypertensive treatment
								Dept. of diabetic treatment

"-": don't have

"+": separate depts.

"++": Combine depts.



	<u>GiaVien</u>	<u>HoaLu</u>	<u>KimSon</u>	<u>NhoQuan</u>	<u>YenKhanh</u>	<u>YenMo</u>	<u>TamDiep</u>	<u>NinhBinh</u>
ENT/Dental/ Ophthalmology	-	++	-	-	√	√	√	√
Surgery	√		√	√	√	√	√	√
Maternity/ <u>Gynecology</u>	√	√	√	√	√	√	√	√
	Inter- commune clinic (2)	Inter- commune clinic (1)	Inter- commune clinic (2)	Inter- commune clinic (4)	Inter- commune clinic (1)	Inter- commune clinic (1)		
								Dept. of hypertensive treatment
								Dept. of diabetic treatment

"-": don't have

"+": separate depts

"++": Combine depts.

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**Table 31: Organization structure of 9 Thua Thien Hue district health facilities compared to the MOH regulation on hospital organization**

	<u>ALuoi</u>	<u>HuongThuy</u>	<u>HuongTra</u>	<u>NamDong</u>	<u>PhongDien</u>	<u>PhuLoc</u>	<u>PhuYang</u>	<u>QuangDien</u>	Hue city
<b>Supporting Department</b>									
Administrative & Organization	√	√	√	√	√	√	√	√	√
Planning and equipment	√	√	√	√	√	√	√	√	√
Financing	√	√	√	√	√	√	√	√	√
Nursing	√	√	√	√	√	√	√	√	√
					Management		Management		
<b>Para-clinical Department</b>									
Laboratory	√	√	√	√	√	√	√	√	√
Imaging Services	√	√	√	√	+	√	√	√	√
Pathology	-	-	-	-	-	-	-	-	-
Infection Control	√	√	√	-	√	√	√	√	-
Pharmacy	√	√	√	√	√	√	√	√	√
Nutrition	√	-	-	-	-	-	√	-	-
	Operating theater	Operating theater	Operating theater	Operating theater	Operating theater Functional Exploration	Operating theater	Operating theater	Operating theater	Operating theater
<b>Clinical Department</b>									
General outpatient	√	√	√	√	√	√	√	√	√
Emergency and Intensive care	√	√	+	√	√	+	+	+	√
<u>Pediatrics</u>	√	++	√	++	++	√	√	√	√

	<b>ALuoi</b>	<b>HuongThuy</b>	<b>HuongTra</b>	<b>NamDong</b>	<b>PhongDien</b>	<b>PhuLoc</b>	<b>PhuVang</b>	<b>QuangDien</b>	<b>Hue city</b>
Internal Medicine	√		√			√	√	√	√
Infectious Disease	√	√	√		√	√	√	√	√
ENT/Dental/ Ophthalmology	√	-	-	++	-	√	√	-	√
Surgery	√	√	√		√	√	√	√	√
Maternity/ <b>Gynecology</b>	√	√	√	√	√	√	√	√	√
Traditional Medicine	√	√	√	√	√	√	√	√	√
				Inter- Commune Clinic (1)	Inter- Commune Clinic (1)	Inter- Commune Clinic (2)			Inter- Commune Clinic (2)

"-": don't have

"+": separate depts.

"++": Combine depts.



**Table 32: Organization structure of 8 Khanh Hoa district health facilities compared to the MOH regulation on hospital organization**

	CamLam	DienKhanh	KhanhSon	KhanhVinh	NinhHoa	VanNinh	CamRanh	NhaTrang
<b>Supporting Department</b>								
Administrative & Organization	√	√	√	√	√	√	√	√
Planning and equipment	√	√	√	√	√	√	√	√
Financing	√	√	√	√	√	√	√	√
Nursing	√	√	√	√	-	√	-	-
Management	Management	Management	Management	-	-	-	-	Management
<b>Para-clinical Department</b>								
Laboratory	√	√	√	√	√	√	-	-
Imaging Services	√	+	+	√	√	√	-	-
Pathology	-	-	-	-	-	-	-	-
Infection Control	-	-	-	-	-	√	-	-
Pharmacy	√	√	√	√	√	√	√	-
Nutrition	-	-	-	-	-	-	-	-
		Operating theater	Operating theater					
<b>Clinical Department</b>								
General outpatient	√	√	√	√	√	-	√	-
Emergency and Intensive care	√	+	√	√	√	√	-	-
Infectious Disease	√	√	√	√	++	√	-	-
Pediatrics	√	√	√	++	√	√	-	-
Internal Medicine	++	√	√	√	√	√	√	-

	CamLam	DienKhanh	KhanhSon	KhanhVinh	NinhHoa	VanNinh	CamRanh	NhaTrang
Traditional Medicine		-	-	√	-	√	-	-
ENT/Dental/ Ophthalmology	-	-	-	-	√	√	-	-
Surgery	√	√	√	√	√	√	-	-
Maternity/ <u>Gynecology</u>	√	√	√	√		√	-	Antenatal clinic
	Inter- Commune Clinic (2)	Inter- Commune Clinic (1)	Inter- Commune Clinic (1)	Inter- Commune Clinic (2)	Inter- Commune Clinic (1)	Inter- Commune Clinic (1)		Inter- Commune Clinic (5)

“-”: don't have

“+”: separate depts.

“++”: Combine depts.

**Table 33: Input data at Luong Tai hospital in Bac Ninh province**

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		Input data										
Type of Service	No. of Staffs	No. of Beds	No. of Discharges	No. of Patient Days	No. of Out-patient Visits	Value of Prescriptions (VND)	No. of Lab Tests	No. of Imaging Services	No. of Ultrasounds	No. of Surgeries	Area (m <sup>2</sup> )	
<b>Total</b>	114	112	5,869	30,593	67,975	8,352,832,588	61,782	50,468	17,576	819	5,999	
<b>Supporting Depts.</b>												
Administrative & Organization	7	-	-	-	-	-	-	-	-	-	527	
Planning	6	-	-	-	-	-	-	-	-	-	392	
Financing	10	-	-	-	-	-	-	-	-	-	712	
Nursing	3	-	-	-	-	-	-	-	-	-	207	
Laboratory	7	-	-	-	-	-	-	-	-	-	477	
Diagnostic Imaging	5	-	-	-	-	-	-	-	-	-	356	
Ultrasound	3	-	-	-	-	-	-	-	-	-	214	
Infection control	3	-	-	-	-	-	-	-	-	-	186	
Pharmacy	6	-	-	-	-	-	-	-	-	-	398	
Operating theatre	2	-	243	1,898	-	257,796,733	-	-	-	-	113	
Emergency and Intensive care	5	9	1,050	3,670	-	327,739,352	2,711	851	333	20	207	
Internal Medicine	7	20	671	5,770	-	180,207,378	2,598	573	324	5	282	
Paediatrics	4	15	653	3,508	-	331,588,941	1,333	292	79	3	154	
Surgery	15	16	1,219	3,584	-	291,507,917	2,210	405	152	111	576	
Maternity/ Gynaecology	12	24	1,251	4,569	-	107,591,276	11,025	14	883	260	449	
ENT/ Dental/ Ophthalmology	2	8	397	2,062	-	59,857,600	583	27	12	114	58	
Traditional Medicine	4	20	385	5,532	-	283,113,102	2,015	1,135	24	-	169	
General Outpatient	14	-	-	-	67,975	6,513,430,290	39,307	47,171	15,769	307	524	
<b>Clinical Depts.</b>												

**Table 34: Direct Cost Assignment and Indirect Cost Allocation at Luong Tai hospital in Bac Ninh province**

	Cost Assignment				Cost Allocation			
	Personnel cost	Drugs and Medical Supplies cost	Building depreciation cost	Medical and non-medical equipment cost	Training/ Research cost	Other costs	Operation cost	Maintenance cost
<b>TỔNG</b>	<b>9,296,200,400</b>	<b>11,832,829,413</b>	<b>1,141,505,387</b>	<b>957,180,607</b>	<b>-</b>	<b>1,485,244,336</b>	<b>739,057,616</b>	<b>121,228,650</b>
<b>Supporting Depts.</b>								
Administrative & Organization	736,580,434 đ	- đ	140,486,799 đ	236,938,027 đ	- đ	96,410,597 đ	26,235,033 đ	- đ
Planning	369,273,203 đ	- đ	28,184,080 đ	6,541,870 đ	- đ	71,656,525 đ	19,499,011 đ	- đ
Financing	694,517,479 đ	- đ	28,184,080 đ	14,365,728 đ	- đ	130,284,591 đ	35,452,747 đ	- đ
Nursing	239,637,027 đ	- đ	12,140,834 đ	- đ	- đ	37,782,531 đ	10,281,297 đ	- đ
Laboratory	715,855,712 đ	1,217,316,006 đ	57,885,764 đ	- đ	- đ	87,290,676 đ	23,753,341 đ	- đ
Diagnostic Imaging	349,091,020 đ	1,252,193,140 đ	34,688,099 đ	114,484,232 đ	- đ	65,142,295 đ	17,726,374 đ	- đ
Ultrasound	267,052,449 đ	346,307,114 đ	11,490,433 đ	29,991,045 đ	- đ	39,085,377 đ	10,635,824 đ	- đ
Infection control	139,038,033 đ	- đ	- đ	284,272,185 đ	- đ	36,479,685 đ	9,926,769 đ	- đ
Pharmacy	494,386,359 đ	- đ	36,115,046 đ	15,747,995 đ	- đ	78,170,755 đ	21,271,648 đ	- đ
Operating theatre	218,084,894 đ	257,796,733 đ	36,115,046 đ	82,576,466 đ	- đ	22,148,380 đ	6,026,967 đ	- đ
Emergency and Intensive care	426,913,772 đ	467,216,642 đ	104,064,296 đ	78,669,874 đ	- đ	70,353,679 đ	27,405,450 đ	2,990,376 đ
Internal Medicine	560,799,184 đ	283,618,187 đ	147,935,173 đ	1,177,649 đ	- đ	95,759,174 đ	27,938,979 đ	680,977 đ
Paediatrics	438,375,520 đ	382,301,995 đ	- đ	- đ	- đ	52,113,836 đ	15,203,496 đ	370,096 đ
Surgery	1,000,731,501 đ	625,072,411 đ	73,967,587 đ	- đ	- đ	195,426,886 đ	98,409,956 đ	16,373,048 đ
Maternity/ Gynaecology	951,254,594 đ	116,104,934 đ	147,935,173 đ	41,704,943 đ	- đ	152,432,971 đ	147,706,742 đ	38,452,976 đ
ENT/ Dental/ Ophthalmology	131,894,988 đ	59,857,600 đ	- đ	- đ	- đ	19,542,689 đ	52,041,446 đ	16,913,388 đ
Traditional Medicine	404,739,625 đ	283,131,372 đ	73,967,587 đ	50,710,592 đ	- đ	57,325,220 đ	15,599,209 đ	- đ
General Outpatient	1,157,974,607 đ	6,541,913,278 đ	208,345,392 đ	- đ	- đ	177,838,467 đ	173,943,328 đ	45,447,790 đ

**Table 35: Cost allocation of supporting depts. to para-clinic depts. & clinical depts. at Luong Tai hospital in Bac Ninh province**

Cost allocation of supporting depts. to para-clinic depts. & clinical depts.					
	Administrative & Organization	Planning	Financing	Nursing	
<b>Supporting Depts.</b>					
Administrative & Organization	1,236,650,890 đ				
Planning	106.60	558,959,378 đ			
Financing	63,804,689.45 đ	101.10	1,074,100,923 đ		
Nursing	116,008,526.28 đ	55,287,772.28 đ	91.10 <sup>7</sup>	383,709,632 đ	
	33,642,472.62 đ	16,033,453.96 đ	34,192,016.22 đ	30,593 <sup>8</sup>	
Laboratory	77,725,712.61 đ	37,042,807.43 đ	78,995,347.82 đ	- đ	
Diagnostic Imaging	58,004,263.14 đ	27,643,886.14 đ	58,951,752.10 đ	- đ	
Ultrasound	34,802,557.88 đ	16,586,331.68 đ	35,371,051.26 đ	- đ	
Infection control	32,482,387.36 đ	15,480,576.24 đ	33,012,981.18 đ	- đ	
Pharmacy	69,605,115.77 đ	33,172,663.37 đ	70,742,102.52 đ	- đ	
Operating theatre	19,721,449.47 đ	9,398,921.29 đ	20,043,595.72 đ	23,805,474.54 đ	
Emergency and Intensive care	62,644,604.19 đ	29,855,397.03 đ	63,667,892.27 đ	46,030,606.71 đ	
Internal Medicine	85,266,266.82 đ	40,636,512.63 đ	86,659,075.59 đ	72,369,645.98 đ	
Paediatrics	46,403,410.51 đ	22,115,108.91 đ	47,161,401.68 đ	43,998,737.97 đ	
Surgery	174,012,789.42 đ	82,931,658.42 đ	176,855,256.31 đ	44,951,960.34 đ	
Maternity/ Gynaecology	135,729,975.75 đ	64,686,693.57 đ	137,947,099.92 đ	57,306,224.00 đ	
ENT/ Dental/ Ophthalmology	17,401,278.94 đ	8,293,165.84 đ	17,685,525.63 đ	25,862,428.08 đ	
Traditional Medicine	51,043,751.56 đ	24,326,619.80 đ	51,877,541.85 đ	69,384,554.86 đ	
General Outpatient	158,351,638.37 đ	75,467,809.16 đ	160,938,283.24 đ	- đ	
<b>Clinical Depts.</b>					

<sup>7</sup> Cost is allocated by number of personnel in Administrative & Organization dept., Planning dept., Financing dept.

<sup>8</sup> Cost is allocated by number of inpatient days in nursing dept.

**Table 36: Cost allocation of Para-clinic depts. to Clinical depts. at Luong Tai hospital in Bac Ninh province**

		Cost allocation of para-clinic depts. to clinical depts.						
		Laboratory	Diagnostic Imaging	Ultrasound	Infection control	Pharmacy	Operating theatre	
Para-clinical Depts.	Laboratory	2,295,865,367 đ	1,977,925,062 đ					
	Diagnostic Imaging	61,782 <sup>9</sup>	50,468 <sup>10</sup>	791,322,183 đ				
	Ultrasound	- đ	- đ	17,576 <sup>11</sup>	550,692,618 đ			
	Infection control	- đ	- đ	- đ	30,593 <sup>12</sup>	819,211,684 đ		
	Pharmacy	- đ	- đ	- đ	- đ	8,352,832,588 <sup>13</sup>	721,001,577 đ	
	Operating theatre	- đ	- đ	- đ	34,165,155.05 đ	25,283,649.97 đ	819 <sup>14</sup>	
	Emergency and Intensive care	100,742,789 đ	33,352,109 đ	14,992,619.88 đ	66,062,233.42 đ	32,143,336.24 đ	17,785,116.43 đ	
	Internal Medicine	96,543,625 đ	22,456,825 đ	14,587,413.94 đ	103,863,511.40 đ	17,674,003.15 đ	4,050,076.02 đ	
	Paediatrics	49,535,278 đ	11,443,967 đ	3,556,807.72 đ	63,146,134.83 đ	32,520,888.23 đ	2,201,128.27 đ	
	Surgery	82,125,254 đ	15,872,625 đ	6,843,478.14 đ	64,514,181.08 đ	28,589,905.16 đ	97,377,914.73 đ	
	Maternity/ Gynaecology	409,697,253 đ	548,683 đ	39,755,205.27 đ	82,244,780.52 đ	10,552,112.64 đ	228,697,227.40 đ	
	ENT/ Dental/ Ophthalmology	21,664,716 đ	1,058,175 đ	540,274.59 đ	37,117,254.85 đ	5,870,588.78 đ	100,591,562.00 đ	
	Traditional Medicine	74,878,908 đ	44,482,542 đ	1,080,549.18 đ	99,579,366.56 đ	27,766,576.00 đ	- đ	
	General Outpatient	1,460,677,543 đ	1,848,710,135 đ	709,965,834.46 đ	- đ	638,810,624.06 đ	270,298,551.73 đ	

<sup>9</sup> Cost is allocated by number of tests.

<sup>10</sup> Cost is allocated by number of imaging services.

<sup>11</sup> Cost is allocated by number of ultrasounds.

<sup>12</sup> Cost is allocated by number of inpatient days.

<sup>13</sup> Cost is allocated by value of prescriptions.

<sup>14</sup> Cost is allocated by number of surgeries.

**Table 37: Calculation the unit cost of discharge, bed-day and outpatient visit at Luong Tai hospital in Bac Ninh province**

	Final result of unit costs			
	Full cost	Cost per discharge	Cost per bed-day	Cost per outpatient visit
Emergency and Intensive care	1,589,262,141 đ	1,513,583 đ	433,041 đ	n/a
Internal Medicine	1,568,304,362 đ	2,337,264 đ	271,803 đ	n/a
Paediatrics	1,149,776,906 đ	1,760,761 đ	327,759 đ	n/a
Surgery	2,724,304,706 đ	2,234,869 đ	760,130 đ	n/a
Maternity/ Gynaecology	2,708,179,035 đ	2,164,811 đ	592,729 đ	n/a
ENT/ Dental/ Ophthalmology	479,593,811 đ	1,209,451 đ	232,587 đ	n/a
Traditional Medicine	1,231,066,618 đ	3,197,576 đ	222,536 đ	n/a
General Outpatient	14,122,758,831 đ	n/a	n/a	207,764 đ
	<b>25,573,246,409 đ</b>	<b>1,951,165 đ</b>	<b>374,285 đ</b>	<b>207,764 đ</b>

Table 38: Cost components at 16/33 facilities (7 components)

	Province	Health Facility	Labor cost	Material cost	Capital cost	Full cost
1	Ninh Binh	Kim Son	16,253,095,971	13,268,811,416	3,576,986,451	33,098,893,837
2		Nho Quan	17,465,217,478	14,013,045,627	5,158,035,043	36,636,298,148
3		Yen Khanh	10,013,514,968	14,663,919,074	1,508,891,985	26,186,326,027
4		Yen Mo	10,134,743,108	16,241,022,567	4,196,501,838	30,572,267,514
		Average	13,466,642,881	14,546,699,671	3,610,103,829	31,623,446,381
5	Bac Ninh	Tu Son	12,947,304,831	14,261,664,215	1,662,597,809	28,871,566,855.8
6		Thuan Thanh	10,868,324,410	16,576,545,360	3,168,606,676	30,613,476,446.9
7		Luong Tai	9,296,200,400	14,178,360,014	2,098,685,994	25,573,246,409.1
8		Bac Ninh CHC	3,457,462,469	9,820,973,000	4,913,481,328	18,191,916,797.5
		Average	11,037,276,547	15,005,523,197	2,309,963,494	25,812,551,627
9	Khanh Hoa	Cam Lam	10,334,879,721	8,121,178,478	5,516,168,733	23,972,226,933
10		Cam Ranh CHC	2,512,464,677	1,679,780,840	360,492,160	4,552,737,678
11		Nha Trang CHC	8,892,447,436	26,194,660,304	1,802,610,580	36,889,718,320
12		Van Ninh	13,994,805,311	13,800,713,136	9,178,741,477	36,974,259,924
		Average	8,947,383,236	7,867,224,151	5,018,467,457	21,833,074,845
13	Thua Thien Hue	Huong Thuy	10,060,203,830	5,844,085,193	2,050,429,028	17,954,718,051
14		Nam Dong	5,352,050,749	2,788,614,057	2,909,650,316	11,050,315,122
15		Quang Dien	10,333,510,323	4,109,354,180	2,172,805,919	16,615,670,422
16		Hue CHC	17,357,084,383	14,113,399,599	1,415,892,192	32,886,376,174
		Average	8,581,921,634	4,247,351,143	2,377,628,421	15,206,901,198



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