

Medical Services for a Provincial Hospital in Vietnam: Cost Analysis for Data Management

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ABSTRACT

Introduction: Health care expenditure has been increasing in both developing and developed nations, but control or improved efficiency can be obtained by applying health economics in management. The unit cost of health care services play a critical role in health economic analyses that involve health economic evaluations.

Aim: To identify the unit costs of medical services at the General Hospital in Lam Dong, Vietnam.

Materials and Methods: A standard costing approach was applied to calculate unit cost of medical services. This study was a retrospective cost analysis, using the descriptive statistic function in Microsoft Excel for Window[®]. All cost centres in the institute were identified and classified into two categories: Temporary Cost Centres (TCCs) and Absorbing Cost Centres

(ACCs). The unit cost of each medical service was estimated by a cost-to-charge ratio method.

Results: The total costs of the Lam Dong General Hospital in the fiscal year 2015 were 4,560,891 USD. The contributions of capital costs, material costs and labour costs for all cost centres to the total direct cost were 16.36%, 49.07% and 34.57%, respectively. After allocation, the direct and indirect costs of all ACCs were 3,590,168 USD and 970,723 USD, accounting for 78.72% and 21.28%, respectively. The cost-to-charge ratios of the remaining medical services ranged from 0.36 to 164.68.

Conclusion: The results of this study can help hospital administrators understand their cost structures and run their facilities more efficiently. The study also provides unit costs for government data and aids in completing the Vietnam standard cost list. This will be helpful for health economic evaluations.

Keywords: Healthcare service, Medical service, Ratio of cost to charge, Unit cost

INTRODUCTION

Costs are usually defined as monetary valuations of resources used in the production of services or goods. In health economic or pharmaco-economic terms, calculating or measuring costs and carrying out a cost analysis are processes that provide researchers, health administrators and policy-makers with knowledge or estimations of the total cost of a medical technology or service in different hospitals and countries. Thus, cost analysis plays a vital role in health economics, and particularly in economic evaluations [1-3]. Recently, unit costs have been introduced into economic evaluations in order to analyse and measure the effects of the distribution of used resources in hospitals or in budgeting and planning exercises [4,5]. Furthermore, costing analysis are used as data for assessing the efficiency of many types of treatment and for determining the costs of treatment versus prevention, which presents an essential role in policy decisions [6].

In developed countries, unit costs are critical for establishing repayment rates, while in developing nations, unit costs are important for determining the reimbursement rate [7]. However, a study by the World Health Organisation (WHO) related to the WHO-CHOICE project has shown that in the majority of countries, and especially in low and average income nations, very few detailed investigations have been carried out on the economics of hospitals [4,8]. In recent years, the need of individual communities to use medical services has been increasing in both developed and developing countries, so hospital managers need to provide these services at an acceptable level of quality and at the least possible cost.

In the past decade, Vietnam, as an example of a developing country, has experienced an increasing demand in the use of health care services and has encouraged the population to use healthcare insurance in order to decrease healthcare expenditures. According to the report of Vietnamese Ministry of Health, in 2010, 60% of the country's population received basic health security and this figure

increased to 75.3% citizens after five years [9]. Nevertheless, the cost of medical services is still a controversial issue because of the differences in health care service costs among different hospitals.

The aim of the study was to describe the unit costs of medical services at Lam Dong General Hospital. The results will provide health care data for Vietnam that can help standardise the unit costs of hospital services and support health economic evaluations.

MATERIALS AND METHODS

Study Design: This retrospective descriptive study was carried out at a provincial Hospital in the Central Highlands region of Vietnam. An economic analysis of hospital medical services was approached using the Ratio of Cost to Charge (RCC) method from a hospital perspective. All costs were estimated based on resources consumed in the fiscal year 2015.

Geographic Location: Lam Dong General Hospital is a government hospital serving both the urban and rural population in the highland area of central southern Vietnam. The General Hospital is a level-2 infirmary with a capacity of 700 beds. In fiscal year 2015, the number of visits and admissions per day were over 1,500 for outpatients and almost 120 for inpatients. The total number of hospital staff working in 35 departments, consisting of 11 Temporary Cost Centres (TCCs) and 24 Absorbing Cost Centres (ACCs), was 658 members, including 124 physicians, 267 nurses and 267 healthcare staff with a bed occupancy rate in the hospital of 101% in 2015. Lam Dong General Hospital was chosen for this study based on their willingness to cooperate and the accessibility of hospital data.

TCCs are comprised of the support and administrative departments and are henceforth referred to as overhead departments. ACCs are generally patient care departments, such as nursing wards, operating room, or diagnostic laboratories.

Data Collection and Management: The period of time spent in collecting the required data for research is defined as the time

horizon during which costs and outputs are to be considered. Ideally, the unit cost analysis covers one whole year to avoid the effect caused by seasonal variations in the numbers of patients, which might ultimately affect the cost per unit of the fixed cost. Annual data were collected in fiscal year 2015.

The main sources of data were the hospital's activity and accounting reports. Comprehensive information about human resources in the studied hospital was taken from the hospital payroll and confirmed by the hospital administrators. Data on variables such as outpatient visits, admissions and bed-days were collected from the medical data in the hospital. Other activity statistics, like the number of laboratory tests and emergency room visits, were taken from the individual departments' registers. Annual recurrent expenditures, which included salaries, drugs and medical supplies, laboratory and radiology materials, fuel and lubricants, office supplies, maintenance and cleaning, communications, water, electricity, telephone, and the internet, were collected from the annual financial report of the hospital.

Components of Costs: Cost components are categorised in various different ways. The most common and well-known categorisation divides costs into three groups: capital cost, labour cost and material cost. Capital costs included annualised discounted depreciation of buildings, vehicles, equipment and furniture that cost more than 10 million Vietnam Dong (VND) and the opportunity cost of land. These costs were calculated based on an economic approach also known as the equivalent annual depreciation cost and defined as "an average combination of depreciation cost and interest on undepreciated the portion of the useful life of the capital item". The interest on the undepreciated the portion of the capital item was calculated based on the concept of the opportunity cost of money spent in advance for that proportion [10]. The interest was calculated for the whole period of the useful life of the capital item and then discounted to the time of analysis. An annuity factor was developed for this purpose. In the calculation, replacement cost was used instead of original cost. According to the regulation of the Vietnamese Ministry of Finance defining a useful year, the replacement cost is adjusted from the original cost with an inflation adjustment factor, which is calculated using the consumer price index factor. Here, the useful years employed were 25 years for buildings and 5 years for equipment [1]. A three-percent discount rate was used to calculate the capital cost of durable assets [5]. Labour costs included salaries, overtime, welfare and other compensation. For staff who worked in more than one cost centre, human resources costs were apportioned based on the working time in each cost centre, as reported by the cost centre supervisors [11]. Material costs consisted of utilities (electricity, water, telephone, internet, etc.), drugs and laboratory and radiology materials, as well as other supplies such as medical supplies, office supplies, and maintenance materials.

Costing Methodology: The accounting and economics fields offer various methodologies for measuring and valuing resources for the costing of health services. Two main methods are available for conducting a unit cost analysis: Activity-Based Costing (ABC) and standard costing. Comparing both methods, ABC has greater accuracy than standard costing. In addition, ABC presents more details on the unit costs of all activities in hospitals. However, this method also consumes more time in data collection and analysis. Thus, in the present study, the unit cost of health care services has been calculated using the standard costing method.

The standard costing method is composed of six steps [2]: Study design and planning; Organisation analysis and cost centre classification; Determination of direct costs of cost centres; Determination of indirect costs; Determination of full costs; Calculation of unit costs of hospital services [Table/Fig-1].

[Table/Fig-1] Six steps of the standard costing method.

In the case where the absorbing cost centre produces only one output (a cost object) or a number of homogeneous outputs (for instance, out-patient services), the average unit costs are used. For multi-product cost centres, a number of methods are available. The micro-costing method is the most accurate but requires a greater workload since it is based on actual resource use [10,11]. This method first determines the direct cost of each service (the number of countable resources that are used in the provision of the service). A second method is the RCC method [12]. This method is relatively less accurate but imposes less of a workload. The ratio of cost to charges is computed based on historical records and is used to estimate the cost of each service from the relevant charge information obtained from patient bills. In this study, the RCC method was used to calculate the unit cost, since insufficient time was available to collect and analyse cost data for the micro-costing method. For instance, in any given period, if the revenue or total charges of a laboratory department were 10,000 USD and total costs were 7,000 USD, the RCC would be 0.7. That ratio was then used in determining the costs for services. Each service charge was multiplied by the RCC, resulting in a unit cost for each service. For example, for triglycerides, the charge was 1.5 USD and the unit cost of this service was 1.05 USD.

Data Analysis and Presentation: The real exchange rate in 2015 was used in the calculation of all costs in US Dollars (USD). According to the report of the Vietnam State Bank in 2015, 1 USD was equivalent 22,547 VND [13]. The total cost of the hospital is presented together with the percentage of the cost component. The unit cost of services in Lam Dong General Hospital was calculated by dividing the cost to charge in 2015. Costing and the use of Microsoft Excel 2013 can be applied for the development of a costing template for unit cost analysis of health care services.

RESULTS

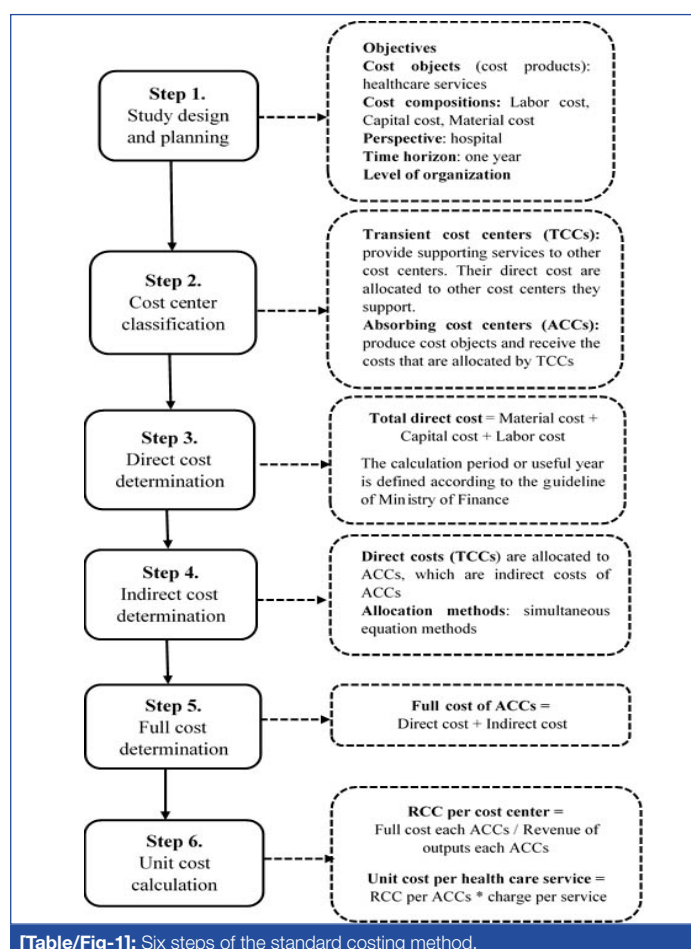
Organisation Analysis and Cost Centre Classification: The organisation structures of the study hospital were based on their function as supporting departments or patient service producing departments. They were classified as TCCs or ACCs, respectively. The hospital had 11 TCCs and 24 ACCs in the period of this research. Each cost centre was coded by either the letter "T" for TCC or "A" for ACC to indicate the group it belongs to.

Direct Costs: [Table/Fig-2] displays the figures of total direct costs obtained by multiple types of cost centres. The table shows that the value of total direct costs (without drugs) for the hospital was only 4,560,891 USD in 2015. The total direct costs without drugs for this hospital were divided into TCCs (21%), and ACCs (79%). Of the total costs, the ratio of capital costs (16.36%): labour costs (34.57%): material costs (49.07%). The smallest cost component was capital costs, at just over 15%. The proportion absorbed by material costs was the largest, at nearly 50%.

These data indicate that material costs contributed to the largest part of ACC costs, at 49.17%. Labour costs accounted for the second highest percentage in both TCCs and ACCs, at 28.56% and 36.20% respectively. The remaining component (capital costs) of total direct costs accounted for only 22.76% in TCCs and 14.63% in ACCs.

[Table/Fig-2] The component of total direct costs and their contribution (USD, 2015), {cost (%)}.

Indirect Cost Determination: The direct costs of TCCs can be allocated according to several methods, but the most accurate method is the simultaneous equation method. Appropriate allocation criteria were selected for each TCC. For instance, utilities such as electricity and water were distributed by each using floor as bed-days to distribute meal charges or the full-time equivalent of all personnel to conduct administration. The results shown in [Table/Fig-3] indicate that internal medicine A (32.49%) and Interventional Cardiology (37.63%) had the highest proportion of indirect costs, while Pharmacy had the lowest percentage of indirect costs, at 10.88%.



Cost centres	Labour cost	Capital cost	Material cost	Direct cost
TCCs	277,191 (28.56)	2,212,755 (22.76)	472,617 (48.68)	970,723
ACCs	1,299,560 (36.20)	525,279 (14.63)	1,765,328 (49.17)	3,590,168
Total	1,576,752 (34.57)	746,195 (16.36)	2,237,945 (49.07)	4,560,891

[Table/Fig-2]: The component of total direct costs and their contribution (USD, 2015), {cost (%)}.
Abbreviations: TCCs, Temporary cost centres; ACCs, Absorbing cost centres.

Full cost determination of ACCs without drugs: After allocating the direct cost of TCCs to the costs of ACCs, the full cost of the ACCs was calculated. The summation required for calculation of the full cost of ACCs is already presented in [Table/Fig-3], and it demonstrates that the total value of the ACC full cost (4,560,891 USD) consisted of two factors: the total direct cost at 78.72% (3,590,168 USD) of the total ACC full cost and the indirect cost at 21.28 % (970,723 USD)

As can be seen in [Table/Fig-1], during the study period, the Pharmacy Department had the largest full cost, at 828,223 USD, including 733,768 USD in direct costs and 94,458 USD in indirect costs. The Interventional Cardiology Unit had the lowest total cost, at 138,028 USD, including 93,878 USD in direct costs and 44,150 USD in indirect costs. The Maternity Unit had direct costs of 273,972 USD, equivalent to 75.31%, for the second highest direct costs in 2015. The Interventional Cardiology Unit, with the lowest direct costs, contributed 181 million to the full cost, corresponding to 52.38%. Separate consideration of indirect costs indicated that the Interventional Cardiology Department had the lowest indirect costs, at 44,150 USD, but the percentage of indirect costs was the highest, at 47.62%.

[Table/Fig-3] Full cost of each ACCs (USD, 2015), {cost (%)}.
Abbreviations: ICU, Intensive care unit; ENT, Ear, nose and throat.

Unit Cost of Hospital Services: [Table/Fig-4] shows the RCC of some departments in the hospital, and [Table/Fig-5] shows the unit costs of basic services for the study hospital. The average RCC

Departments	Cost centres	Direct cost	Indirect cost	Total cost
Pharmacy	A1	73,376.22(89.12)	89,561.61(10.88)	823,326.83
Laboratory	A2	192,411.82(84.69)	34,779.66(15.31)	227,191.47
Imaging and Functional Exploration	A3	363,585.73(85.07)	63,786.42(14.93)	427,372.15
Examination – Emergency	A4	260,703.30(76.90)	78,330.27(23.10)	339,033.57
Haemo-dialysis	A5	93,878.04(68.16)	43,858.34(31.84)	137,736.38
ICU - Antitoxic	A6	228,527.89(77.89)	64,888.58(22.11)	293,416.47
Ophthalmology	A7	66,354.29(77.27)	19,522.92(22.73)	85,877.22
ENT	A8	63,998.03(75.76)	20,473.27(24.24)	84,471.30
Dental	A9	84,262.61(77.51)	24,443.82(22.49)	108,706.43
Maternity Unit	A10	273,972.40(72.66)	103,091.28(27.34)	377,063.68
Paediatrics	A11	163,230.75(70.39)	68,649.13(29.61)	231,879.88
Infectious Disease - Dermatology	A12	88,037.00(77.55)	25,483.53(22.45)	113,520.53
Surgery/ anaesthesiology/ recovery	A13	193,929.83(79.27)	50,723.41(20.73)	244,653.24
General Surgery	A14	152,512.53(75.61)	49,194.94(24.39)	201,707.47
Traumatology	A15	155,568.00(73.73)	55,424.22(26.27)	210,992.22
Internal Medicine A	A16	99,681.39(67.51)	47,975.38(32.49)	147,656.77
Internal Medicine B	A17	100,980.51(72.81)	37,718.94(27.19)	138,699.45
Internal Medicine II	A18	51,527.26(69.54)	22,573.43(30.46)	74,100.69
Traditional medicine	A19	23,785.27(61.71)	14,757.43(38.29)	38,542.70
Rehabilitation and Physiotherapy	A20	31,327.86(80.93)	7,383.99(19.07)	38,711.85
Tuberculosis	A21	61,991.62(71.35)	24,896.45(28.65)	86,888.06
Anatomic Pathology	A22	18,367.49(78.40)	5,060.55(21.60)	23,428.04
Interventional Cardiology	A23	8,056.67(62.37)	4,861.42(37.63)	12,918.09
Nuclear medicine	A24	79,712.48(85.72)	13,284.41(14.28)	92,996.89
Total		3,590,167.99(78.72)	970,723.39(21.28)	4,560,891.38

[Table/Fig-3]: Full cost of each ACCs (USD, 2015), {cost (%)}.
Abbreviations: ICU, Intensive care unit; ENT, Ear, nose and throat.

was 11.72 (range from 0.36 to 164.68), which means the cost for practicing the service is higher than the current price of the service itself. Most of the cost centres had current prices of hospital services that did not match the real costs expensed for these services. Some faculties had an RCC smaller than 1.00, include Imaging and Department of Functional Exploration (0.60), Recovery-Toxicol (0.47), ENT (0.96), Maternity Unit (0.75), General Surgery (0.60), Traumatology (0.63) and Internal Medicine B (0.85).

The average hospital unit costs showed considerable differences between the various ACCs. Of the different wards in the study

Cost centre	Total cost	Revenue	RCC
A2	823,326.83	628,419	0,36
A3	227,191.47	708.030	0,60
A4	427,372.15	208.642	1,62
A5	339,033.57	5.741	23,99
A6	137,736.38	622.650	0,47
A7	293,416.47	55.315	1,55
A8	85,877.22	88.408	0,96
A9	84,471.30	41.252	2,64
A10	108,706.43	500.923	0,75
A11	377,063.68	172.661	1,34
A12	231,879.88	41.158	2,76
A13	113,520.53	5.491	44,56
A14	244,653.24	334.833	0,60
A15	201,707.47	337.515	0,63
A16	210,992.22	92.475	1,60
A17	147,656.77	163.789	0,85
A18	138,699.45	22.391	3,31
A19	74,100.69	23.422	1,65
A20	38,542.70	5.187	7,46
A21	38,711.85	73.080	1,19
A22	86,888.06	-	-
A23	23,428.04	78	164,68
A24	12,918.09	15.380	6,05
Total	4,560,891	4,146,837	11.72

[Table/Fig-4]: RCC in absorbing cost centres, 2015.

Abbreviations: RCC, ratio of cost to charge.

hospital, the bed-days cost was the highest in the Nuclear Medicine and Tumour ward (13.68 USD) and was the lowest for Traumatology (1.11 USD). The OPD visit cost did not differ much across specialties (0.86 USD).

[Table/Fig-4] RCC in absorbing cost centres, 2015.

[Table/Fig-5] RCC and unit costs of some medical services in Lam Dong General Hospital (USD, 2015).

DISCUSSION

Total Direct Costs of Cost Centres: This may be the first comprehensive study on the economics of a hospital that presents the total direct costs and unit costs of medical services. In terms of cost centre groups, the total direct costs of the ACCs, at 3,590.168 USD (78.72%), is greater than that of the TCCs at 970.723 USD (21.28%) for the General Hospital in Lam Dong Province in 2015. In terms of total direct costs, material costs, at 2,237,945 USD (49.07 percent), accounted for the largest proportion and capital costs, at 746.195 USD (16.36 percent), made up the lowest proportion. For direct costs, the golden ratio of labour costs: material costs: capital costs are 20:50:30, so the research indicated that many departments had an unacceptable cost ratio. These departments often had a high proportion of labour costs and a low percentage of capital costs; however, they had a low RCC under 1.00.

Comparison of the Results of Unit Cost Analysis to Other Studies: To our knowledge, several similar studies have been conducted for unit cost analysis in Vietnam. When compared with the cost analysis results from Ha Nam General Hospital and Thu Duc General Hospital [14], the results of this study show various differences. In terms of costing methods, the present study used the standard costing method, which was also used to conduct the cost analyses in these other hospitals. The main difference is that the Ha Nam General Hospital and Thu Duc General Hospital studies used micro-costing and RCC, whereas the present Lam Dong General Hospital analysis used the RCC method to calculate the unit cost

Departments	Services	Charge	RCC	Unit cost
Laboratory	Triglyceride	3.99	0.36	1.45
	Troponin I	6.43	0.36	2.34
	TSH	3.73	0.36	1.36
	CEA	3.10	0.36	1.12
	Glucose	1.15	0,36	0.42
Examination - Emergency	Cut suture	0.53	1.63	0.87
	Cut the boil, small abscess	0.53	1.63	0.87
	Paracentesis/ Thoracentesis	0.53	1.63	0.87
	Out-patient visit	0.53	1.63	0.87
ICU - Antitoxic	Arterial catheterization for continuous blood pressure monitor	36.55	0.46	16.84
	Intubation	3.73	0.46	1.72
Ophthalmology	Tonometry	15.52	1.60	24.87
	Trabeculectomy	17.74	1.60	28.42
	Measure Javal	0.53	1.60	0.85
Imaging and Functional Exploration	Hirtz X-Ray	2.04	0.60	1.22
	EEG	2.13	0.60	1.28
	Doppler ultrasound	6.65	0.60	3.99
	Pelvis X-Ray	2.40	0.60	1.44
	Nadeau X-Ray	2.04	0.60	1.44
	Clavicles X-Ray	2.93	0.60	1.76
General Surgery	Endoscopy nose	2.88	0.60	1.73
	Endoscopy ear	2.88	0.60	1.73
	Endoscopy ENT	6.65	0.60	3.99
	Cut a part of a small intestine	96.51	0.60	57.91
Traditional medicine	Galvanopuncture	1.11	1.65	1.83
	Speech/ activity therapy	0.67	1.65	1.11
	Infrared	0.80	1.65	1.32
	Traction therapy by ELTRAC machine	0.44	1.65	0.73
Rehabilitation and Physiotherapy	Massage by vibrator	0.44	7.46	3.28
	Respiratory physiotherapy	0.44	7.46	3.28
	Massage by hand (60 minutes)	1.33	7.46	9.92

[Table/Fig-5]: RCC and unit costs of some medical services in Lam Dong General Hospital (USD, 2015)

Abbreviations: RCC, Ratio of cost to charge; ICU, Intensive care unit; TSH, Thyreostimulin Hormone; CEA, Carcinoma Embryonic Antigen; EEG, Electroencephalogram; ENT, Ear, nose and throat.

per healthcare service. The present study was conducted over a short duration, so the RCC method is a good option because it consumes less time and the calculations were straight forward.

Considering the cost components of direct costs among these hospitals, in general, the proportion of labour costs to the total direct costs was lower at Lam Dong General Hospital (34.57%) than at Ha Nam General Hospital (46%) but higher than at Thu Duc General Hospital (31%). The contribution of material costs was lowest at Ha Nam General Hospital, at 21%, while this percentage of capital costs was 49.07% at Lam Dong hospital. The capital costs at Thu Duc General Hospital accounted for 62% of the total direct costs, which might reflect the fact that Thu Duc General Hospital is one of the biggest hospitals in Ho Chi Minh City and provides more health care services than the others.

CONCLUSION

The great majority of health managers in Vietnam are now confused between the concepts of "costs" and "charges", as well as the relationship between the two. This reflects the fact that hospital services in Vietnam are still heavily subsidised by the State.

The results of this simulation analysis provide an empirical basis for health policymakers in Vietnam to assess and negotiate different

provider payment reform options and to make decisions that are more likely to advance health system objectives, and they highlight the importance of costing exercises as a hospital planning and management tool. The present study was a preliminary study on the cost of services in a provincial hospital in Vietnam. Further studies on this issue, with larger sample sizes and more sophisticated designs, should be done as soon as possible to provide clearer and more detailed data about the levels and determinants of hospital costs in Vietnam.

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