

4.2 RESULTS FROM STEP-DOWN COST ACCOUNTING AT SJGH

4.2.1 COSTS BY COST CENTRES

The sum total of medical costs at SJGH is 1,049,025 thousand LKR in 2005. This cost is divided among 62 Cost Centres with the Cost Centres classified at three levels: *Final Cost Centre* (20 centres, 490,997 thousand LKR), *Intermediate Cost Centre* (19 centres, 448,464 thousand LKR) and *Overhead Cost Centre* (23 centres, 109,565 thousand LKR). This expenditure-based calculation is the initial calculation for cost accounting. The detailed cost structure for each level of Cost Centre is given in **Table 4- 10** and **Table 4- 12**.

TABLE 4- 10: COST STRUCTURE FOR OVERHEAD COST CENTRE

Overhead Cost Centre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	M .R .O	E .M .E	Maintenance	Mortuary	T.Exchange	Transport	Welfare	Dr,s Res	Chairman,s office	Dire office	De.Di.Office	Secret,s off	Matron off	ICN	Accounts	Establish	Supplies	Int Aud Bran	Library	Stores	Gov.audit	Plan dep	SCU
Personnel	9,669	2,506	12,362	2,403	2,185	4,485	2,094	766	815	1,690	1,234	1,106	3,820	2,411	10,437	6,191	5,153	2,030	1,064	898	215	1,069	727
Medical material	669	162	831	198	162	243	142	61	20	81	41	61	203	20	709	385	365	162	61	101	20	41	41
Other Cost	1,621	545	3,085	588	378	517	341	415	110	239	134	177	478	43	1,707	7,860	1,141	345	215	1,505	124	126	140
Depreciation	100	3,492	423	77	386	1,504	13	90	63	73	30	48	28	0	326	114	167	30	71	449	26	19	93
TOTAL	12,060	6,704	16,701	3,266	3,110	6,749	2,591	1,332	1,008	2,083	1,438	1,391	4,529	2,475	13,180	14,551	6,826	2,566	1,410	2,954	385	1,254	1,001

TABLE 4- 11: COST STRUCTURE OF INTERMEDIATE COST CENTRE

Intermediate Cost Centre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Ward-03	Ward-04	Ward-05	ICU	O.T	CTOT	Labour room	CIU	CSSD	Pharmacy	X-ray	Path -lab	Physiotherapy	Bloodbank	ECG/EEG	Endoscopy	kitchen	Laundry	Sewing room
Personnel	7,186	7,201	8,227	15,399	29,161	7,411	8,958	1,730	4,800	9,135	10,911	27,213	3,572	6,152	5,510	1,322	9,846	326	1,539
Medical material	3,510	3,548	3,790	12,689	79,653	29,339	3,629	818	5,583	518	660	5,733	164	2,088	589	716	770	20	122
Other Cost	2,524	2,181	2,296	5,359	25,935	3,093	3,984	331	1,126	1,363	4,013	3,867	430	862	672	309	6,889	4,903	401
Depreciation	673	515	662	3,186	10,672	19,654	2,072	4,538	133	206	8,329	3,912	146	395	8	1,963	624	644	53
TOTAL	13,894	13,445	14,975	36,632	145,422	59,497	18,644	7,418	11,641	11,222	23,912	40,725	4,312	9,497	6,780	4,310	18,129	5,894	2,115

TABLE 4- 12: COST STRUCTURE OF FINAL COST CENTRE

Final Cost Centre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Ward-01	Ward-02	Ward-06	Ward-07	Ward-08	Ward-09	Ward-10	Ward-11	Ward-12	Ward-14	Ward-15	Ward-16	Ward-17	Ward-18	Ward-19	NICU	Dialysis	ETU	OPD+ Clinic	Medical check up
Personnel	9,671	14,782	13,579	10,897	9,863	14,760	10,226	7,953	10,740	11,142	9,118	7,976	11,982	19,223	5,877	15,512	6,902	18,130	8,321	605
Medical material	6,317	7,857	12,524	5,128	5,336	8,502	6,602	4,884	13,267	7,970	7,717	3,404	12,168	18,257	3,636	6,917	12,864	3,516	45,845	2,180
Other Cost	2,617	3,503	3,797	2,746	2,744	3,447	2,581	2,269	3,153	2,856	2,606	2,206	3,312	3,984	2,424	2,175	1,653	2,751	4,776	114
Depreciation	603	699	821	720	458	1,609	565	415	586	642	467	2,508	1,070	2,945	2,255	1,554	1,574	282	3,353	8
TOTAL	19,208	26,841	30,720	19,490	18,401	28,318	19,974	15,521	27,747	22,609	19,908	16,094	28,531	44,410	14,191	26,159	22,993	24,678	62,295	2,907

4.2.2 STEP-DOWN COST ACCOUNTING RESULTS

The following results are derived using the step down procedure laid out above. The results presented in **Table 4- 10, Table 4- 11,** and Table 4- 12 relate to **step 1.**

Table 4-13 below shows the step-down procedures corresponding to **step 2, step 3,** and **final costs: Step 2** reallocates overhead costs to intermediate and final Cost Centres;

- The adoption of **step 3** of the step-down procedure becomes slightly more complex as a distinction is made at SJGH between intermediate Cost Centres that directly serve final Cost Centres and those that serve both other intermediate and final Cost Centres. The 3rd layer of the table presents the costing results once the intermediate costs A and B are appropriately reallocated.
- The bottom layer of the table shows how the total costs (aggregation of overhead, intermediate and final costs) have been reallocated and consolidated as **final costs.**

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TABLE 4- 13: RESULTS OF STEP-DOWN COST ACCOUNTING AT SJGH

'000Rs.	Final		Inter (A)		Inter (B)		Overhead		TOTAL	
Personnel Cost	217,258	44%	85,274	28%	80,326	58%	75,331	69%	458,189	44%
Material Cost	194,892	40%	136,976	44%	16,962	12%	4,778	4%	353,608	34%
Other Cost	55,712	11%	45,704	15%	24,835	18%	21,833	20%	148,085	14%
Depreciation	23,135	5%	41,973	14%	16,414	12%	7,622	7%	89,144	8%
TOTAL	490,997		309,926		138,537		109,565		1,049,025	

'000Rs.	Final		Inter (A)		Inter (B)	
1st Allocation TOTAL	490,997	87%	309,926	93%	138,537	90%
Overhead CC	70,307	13%	23,475	7%	15,783	10%
TOTAL	561,304		333,401		154,320	
	(54%)		(32%)		(15%)	

TOTAL	
939,461	90%
109,565	10%
1,049,025	

'000Rs.	Final		Inter (A)	
1st Allocation TOTAL	490,997	71%	309,926	87%
Overhead CC	70,307	10%	23,475	7%
Intermediate CC (B)	131,570	19%	22,750	6%
TOTAL	692,874		356,151	
	(66%)		(34%)	

TOTAL	
800,923	76%
93,782	9%
154,320	15%
1,049,025	

'000Rs.	Final	
1st Allocation TOTAL	490,997	47%
Overhead CC	70,307	7%
Intermediate CC (B)	131,570	13%
Intermediate CC (A)	356,151	34%
TOTAL	1,049,025	

TOTAL	
490,997	47%
70,307	7%
131,570	13%
356,151	34%
1,049,025	

4.2.3 CONSIDERING COSTS OF FINAL COST CENTRES

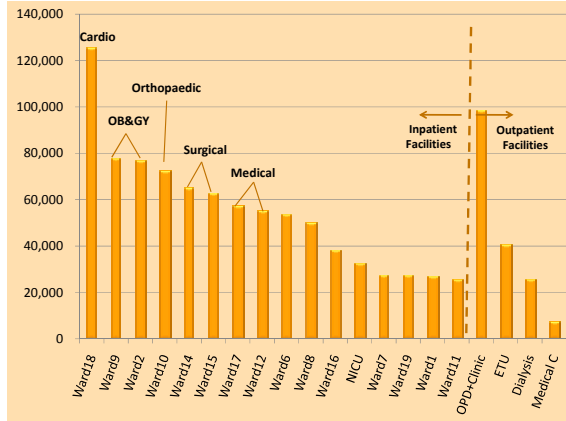


FIGURE 4- 7: COSTS OF ONLY FINAL COST CENTRES

The analysis below is based on the estimates for the final Cost Centres after the step-down procedures have been adopted. The highest cost is for Ward 18, followed by OPD+ Clinic, Ward 9 and Ward 2. High personnel costs and operation costs in the Cardio-thoracic Ward (Ward 18) result in this outcome. The cost of OPD + Clinic is higher than other Cost Centres because drug costs account for a large share of hospital costs (42% of the total costs). In the case of Wards 9

and 2 (which are the OB & GY departments) costs of operations and delivery are over 40%, and so contribute to high costs.

As the next step of this exercise, similar wards are combined, and final Cost Centres are given in the form of Specialities. Providing cost information in this form is more appropriate in enabling comparisons with other institutions. Cost by speciality can be ranked as Surgical, Medical, and GYN & OBS. Both Surgical and Medical departments have 3 wards each, and thus the totals become very high. Each of the first four departments ranked highest cost over 100 million LRS each. And the total cost of these 4 medical departments accounts for 60 percent of the total cost of the hospital.

Given that patient numbers vary significantly by speciality it is important to calculate cost per patient, as this value is of greater significance in programme planning and cost control, and for comparison with other institutions and over time.

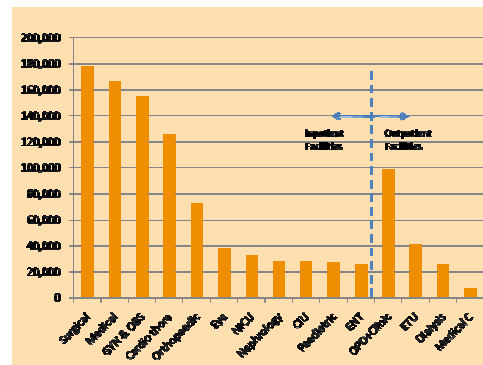


FIGURE 4- 8: COSTS BY SPECIALITIES

With regard to costs per patient on the basis of each department, the Cardio department is the highest (Rs.70, 828), followed by the NICU (Rs.37, 112) and the Orthopaedic department (Rs.29, 242). The costs of NICU are not high compared to other Cost Centres; costs per patient are high, as it caters to a small number and involve intensive nursing.

With regard to costs per patient per day, the departments show a similar trend as costs per patient. However, the ranking of cost per patient per day of the dialysis department goes up significantly in

comparison to its ranking under 'costs of only Final Cost Centres', 'costs by speciality' and 'cost per patient by speciality'.

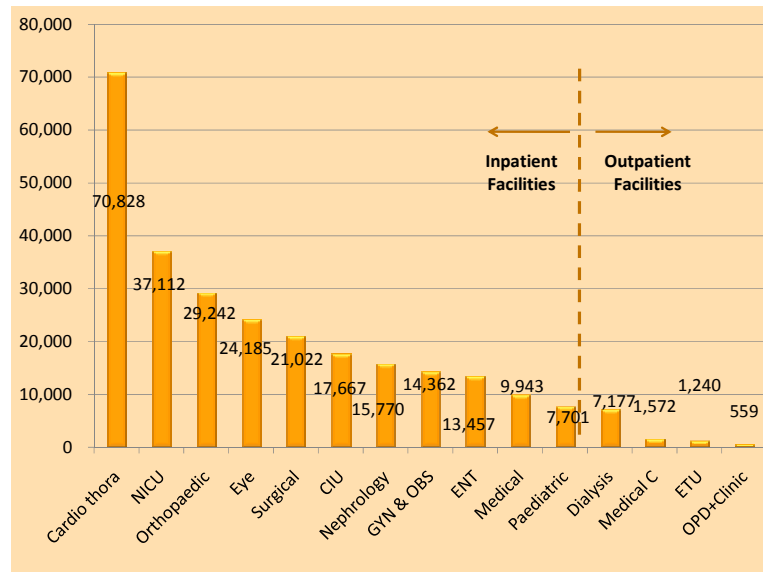


FIGURE 4- 9: COSTS PER PATIENT (SPECIALTY-WISE)

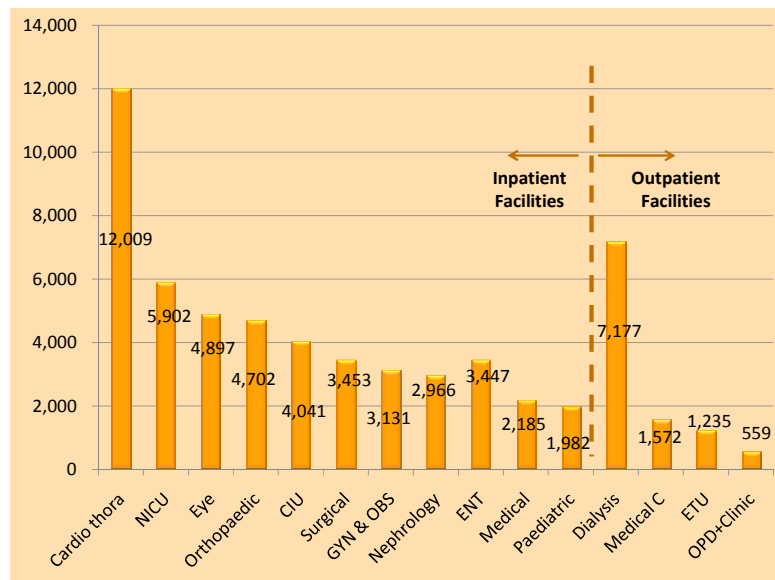


FIGURE 4- 10: COSTS PER PATIENT PER DAY (SPECIALTY-WISE)

4.2.4 ISSUES ARISING FROM THE SJGH COST ACCOUNTING EXERCISE

Through studying the situation at SJGH it can be concluded that though Cost Centres collect useful information, the recorded data in its present format, is not particularly appropriate for purposes such as decision making and cost control. Therefore such information is currently not fully utilized for such purposes. Development of a new recording system, using a spreadsheet, and involving the step-down

procedure will facilitate a better understanding of costing issues. Improving the recording system to incorporate various sources of information and enhancing the efficiency and regularity of the flow of information would ensure the operation of an effective cost accounting system within the hospital, and would result in better management decision making, planning and appropriate resource allocation.

Table 4-14 presents a compilation of the main issues, the causes, remedies and expected results by department to be achieved through introducing more systematic cost accounting at SJGH.

TABLE 4- 14: INFORMATION MANAGEMENT ISSUES AT SJGH

Department Name	Issue	Possible Cause	Improvement Method	Expected Result
Pharmacy	It is difficult to find out the amount of each drug issued. (As pages get used up due to the frequency of records, the next records do not appear consecutively in the book but in the next available space. Then a drug issue book has several pages relating to the same drug but in different parts of the book making aggregation by drug difficult.)	At present the drug Issue/Receipt Book, is only used to find out the balance of issue and receipt per drug.	Prepare drug files in alphabetical order, and add forms as needed.	It will become easier to find out the amount of each drug issued and to evaluate information regarding drug issues each year.
	It is difficult to find out the amount of drugs issued per Cost Centre.	This is due to the current purpose of the Issue/Receipt Book, as it has only been used to find out the balance of issue and receipt per drug.	The price and the issued amount of individual drugs are calculated per Cost Centre.	Cost awareness will develop within the system
X-ray	The type and the number of films used are not stated on patient records.	It is due to only a monthly calculation being done using the machine's counter.	A column to write the type and the number of films to be added to patient records.	It will be useful for managing the use of films and the stock, as detailed data for films can then be found out.
	It is difficult to find out the number of films (the number of patients) per Cost Centre.	It is because there was no necessity to calculate x-ray costs per Cost Centre, although statistics for the total number of patients and x-rays are calculated every	A new Cost Centre-based spreadsheet is prepared.	With detailed data it will be possible to analyze and handle issues in accordance with each Cost Centre's

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		month and Cost Centre is also clearly included in the records.		situation.
Lab-Tests	It is difficult to find out the number of samples (the number of patients) per Cost Centre.	It is because there was no necessity to calculate laboratory test costs per Cost Centre, although statistics for the total number of patients and tests are calculated every month and the Cost Centre is clearly included in the records.	A new Cost Centre-based spreadsheet is prepared.	With detailed data it will be possible to analyze and handle issues in accordance with each Cost Centre's situation.
Kitchen	The number of diets in each month per Cost Centre is not calculated.	It is because there was no necessity to calculate diet costs per Cost Centre, although statistics for the total number of patients and diets are calculated every month and Cost Centre is also clearly included in the records.	A new Cost Centre-based spreadsheet is prepared.	With detailed data it will be possible to analyze and handle issues in accordance with each Cost Centre's situation.
Para-medical in general	Information management in the past is not sufficient. (It is not clear as to which book has annual information recorded. Also, there is a problem in the storage conditions such as missing records in a department, etc.)	It is because there was no need to reuse past records.	Used records are filed and stored in accordance with each fiscal year.	Data is then available when necessary.
Paying Wards	It is difficult to find out the number of patients per specialty.	It is because there was no necessity to calculate costs per specialty.	The number of patients per month and per specialty is calculated.	More detailed statistics relating to patients can be prepared, which is useful for an efficient administration of Paying Wards.

4.3 ESTIMATING THE TREATMENT COST OF SELECTED DISEASES ADOPTING STEP DOWN COSTING RESULTS

4.3.1 INTRODUCTION

The JICA EBM study addresses the costing of the health system from two different perspectives: hospital based costing (see above) and disease management costing. The THK and BHK, both in the Kurunegala district of the North Western Province are used as case studies for both forms of costing while work on disease management costing is also done at the Colombo North Teaching Hospital (CNTH), Ragama.

Analysis of the cost of management of diseases is a major step towards appropriate resource allocation. Initiating protocol based management of diseases, and then costing such protocols will lead to improved accountability. There are many complexities involved in disease management based costing. The work undertaken by this study is therefore also of particular importance in helping to develop a framework for the collation and analysis of disease management related cost data.

Accountability is an important element in the practice of evidence based medicine. In the state sector hospitals, disease management is not often based on protocols. Absence of well developed and accepted protocols to cover the entire disease spectrum is a deficiency of the Sri Lankan curative system. This issue is currently being addressed to some extent, for some diseases, by the medical practitioners through their respective Colleges. The development of such protocols would further support such disease management costing exercises.

The objectives of this study in particular are determining the costs incurred by the hospitals/state health sector for the treatment of selected diseases; and the demonstration of the methodology adopted in determining disease specific treatment costs, that would in turn provide the basis for more generalized disease management based costing.

4.3.2 COMPLEXITIES OF DISEASE MANAGEMENT BASED COSTING

Given below are the complexities of disease management based costing identified in the course of this study, in the context of the three steps involved in carrying out such work: the identification of the relevant protocols for each disease, the costing of protocols and the evaluation of cost estimates and aggregation procedures.

A. STEP 1: IDENTIFYING RELEVANT PROTOCOLS:

(1) Analyzing the cost of treating a disease is hampered by the wide divergences that may exist in disease severity and the range of symptoms. Protocols need to be designed in line with severity of illness and in some cases taking into account the co-morbidities and patient specific characteristics (i.e. age, allergies). This study has resolved these difficulties in the following manner:

Selection of conditions: Choice of Caesarean section for example was determined by the fact that the treatment protocol is relatively standardized. Costing the two non-communicable diseases: asthma and ischaemic heart disease are likely to prove more complex.

Focusing on specific levels of severity: in the case of Caesarean sections – on uncomplicated cases, and for asthma on acute severe cases.

Use of inclusion and exclusion criteria.

(2) Variation may exist between ideal and actual protocols.

Comparison of protocols between the three hospital settings: variation may well exist particularly between treatment in a Teaching Hospital and a Base Hospital due to differences in resources: manpower, equipment and even availability of drugs.

B. STEP 2: COSTING OF PROTOCOLS:

(1) The cost of a specific disease management protocol is strongly influenced by the use of manpower. Two different aspects are of importance here:

- Time spent on a task

A **time study** was essential to determine the time spent on different activities included in the treatment protocol. This study used a prospective study at the North Colombo Teaching Hospital involving selected conditions to determine the time spent by different healthcare providers on different activities. The results of this time study were then incorporated into the costing of disease management protocols in the Teaching Hospital Kurunegala and the Base Hospital Kuliyaipitiya as well. The choice of carrying out the time study at the Colombo North Teaching Hospital is justified on the grounds that what are of interest in achieving a cost-effective outcome are 'ideal' (best) treatment practices (more likely to be observed among experienced Teaching hospital staff than among less experienced staff in the peripheral hospitals).

- Qualifications/experience of healthcare workers

This would be reflected in the differences in the salary structures

(2) The cost of a specific disease management protocol could also be affected by the availability and quality of equipment and drugs. Differences in this regard would affect efficacy as well as cost; with high efficacy combined with low cost suggesting greater cost-effectiveness.

C. STEP 3: EVALUATION OF ESTIMATES AND AGGREGATION

- Examining the cost estimates across individuals and across hospital settings
- Annual aggregation may be affected by seasonal effects (i.e. in the case of asthma)
- National aggregates are dependent on disease incidence and prevalence

4.3.3 STUDY PLAN

This study is a descriptive cross sectional study involving two different costing strategies. *Actual Cost Accounting* measures the total costs accrued by a patient afflicted by a particular disease. Such costs have a wide range of variations as the actual treatment procedures vary from one patient to another. On the other hand, *Standard Cost Accounting* focuses on the standardised treatment procedures of a certain disease, where variations in treatment among patients are not considered.

In this study, time costs of healthcare personnel relating to different treatment tasks are based on the standard cost accounting methodology while costing the other aspects of care such as drugs, investigations and treatment procedures are based on actual cost accounting. Costing strategy II discussed below provides information on staff time based on the standard cost accounting procedure at CNTH, which is then used for costing all three facilities. It should however be noted that differences in size and sophistication of the facility (particularly since this determines staff experience/qualifications) may have some impact on staff times (i.e. more experienced staff may spend less time for conducting standard procedures).

A. STUDY DESIGN

- Costing strategy I:

This exercise was conducted retrospectively (on patients treated in the past). Data were obtained from the Bed Head Tickets (BHT). The actual cost of treating the condition was determined by identifying each cost item in the treatment process.

- Costing strategy II:

This exercise was conducted prospectively by following up patients during their entire hospital stay. Data were obtained from the BHT as well as from the health personnel involved in the treatment of the patient.

B. STUDY SETTING:

Costing strategy I was conducted in the Teaching Hospital Kurunegala and Base Hospital Kuliypitiya in the North-Western Province of Sri Lanka. Costing strategy II was conducted in Colombo North Teaching Hospital, Ragama.

C. STUDY PERIOD:

The study was conducted from September-December 2006.

D. STUDY POPULATION:

- Costing strategy I:

Subjects who received in-patient care in the THK and BHK during the period 1st January to 30th June 2006 for the following conditions

- Uncomplicated Lower Segment Caesarean Section (LSCS)
- Acute severe asthma
- Ischaemic heart disease

- Costing strategy II:

Subjects who received in-patient care in the Colombo North Teaching Hospital, Ragama during the period between 15th September and 30th November 2006, for the following conditions:

- Uncomplicated Lower Segment Caesarean Section (LSCS)
- Acute myocardial infarction
- Acute severe asthma
- Excision of breast lump

4.3.4 SELECTION OF DISEASES FOR STUDY

The selection of diseases for the study was based on their relative importance with respect to the burden of disease, availability of a sufficient number of cases of an identified level of severity and the practicability of obtaining the required information retrospectively as well as prospectively.

Ischaemic heart disease is the leading cause of hospital mortality in Sri Lanka. The importance of ischaemic heart disease as a public health problem led to its selection. Further it was noted that a sufficient number of cases of the selected level of severity could be obtained from both Base and Teaching Hospitals in the Kurunegala district. In the case of Colombo North Teaching Hospital Myocardial infarction

was selected. The number of direct admissions to this hospital for the management of myocardial infarction is considerable because of its highly populous semi-urban catchment area. The facilities for the management of myocardial infarction are limited at lower level hospitals so a sufficient number of cases may not have been available at Base Hospital level. Focusing on Myocardial Infarction is important, however, since it allowed for a variety of treatment procedures to be included in the time study.

Bronchial asthma is a common condition treated at all levels of hospitals in Sri Lanka. Comparison of the management at different hospitals is possible because guidelines for the management of asthma have been drawn up by the Sri Lanka Medical Association in 2005. Therefore it was considered important to include this disease in the study since a standardized accepted treatment protocol existed.

Lower segment caesarean section (LSCS) was included because it was considered a procedure that had a standardized treatment protocol, if the sampling were limited through inclusion and exclusion criteria. It is performed commonly at all levels of hospital which have specialist obstetric care.

Breast tumour excision was selected as a proxy for common surgical procedures. It involves only a limited surgical intervention and a short duration of hospital stay. Here too, the objective was the collection of time study data on the procedures related to this intervention.

4.3.5 SAMPLING AND DATA COLLECTION INSTRUMENTS

A. SAMPLE SIZE

TABLE 4- 15: SAMPLE SIZE AT RESPECTIVE HOSPITALS

Condition	TH Kurunegala	BH Kuliya pitiya	North Colombo TH
Uncomplicated LSCS	40	40	40
Acute severe asthma	40	40	40
Ischaemic heart disease	39	40	
Acute myocardial infarction			40
Excision of breast lump			40

B. SAMPLING PROCESS

The patients were purposively sampled considering the inclusion criteria identified for each type of disease consecutively until the required sample size was obtained. In costing strategy I the

subjects were recruited considering the information available on the Bed Head Ticket. In costing strategy II recruitment was based on clinical opinion as well as on the information given in the patient records.

c. DATA COLLECTION INSTRUMENTS AND PROCEDURES

- Data extraction forms used to report on information such as length of stay, types of medication, investigations taken from the BHTs in costing strategy I and patient information in costing strategy II;
- Forms for reporting cost data relating to investigations, drugs, treatment, salaries etc.
- Survey of expert opinions used in formulating treatment protocols

The forms were pre-tested and modified according to the findings of the pre-test in September 2006.

For costing strategy I the data were collected by Grade I/II medical officers working in the hospitals where the study was conducted. For costing strategy II the data were collected by pre-intern medical graduates under the supervision of the principal investigator.

Computerization of BHT information as in Kurunegala and the systematic storage of BHTs (by ward and BHT number) at North Colombo Teaching Hospital facilitated easy data collection. The information needed to determine the cost of each component were extracted from the BHT or determined through observation and entered in the data collection form. Where necessary, information was also sought from clinicians (key experts) regarding costs and protocols.

A time study was conducted for observing the patient and the health care givers as the patient goes through the different procedures in the course of management of his/her disease. The time spent for procedures such as clerking at admission, procedures carried out in the Emergency Treatment Unit (ETU), registration in the ward, intravenous (IV) cannulation, bladder catheterization etc. were measured and recorded to the closest minute. The category of staff involved in each procedure was also noted. This was done for all the patients studied at the Colombo North Teaching Hospital. Average times spent on each procedure were then calculated and this information was utilized for costing staff time at all three sites.

4.3.6 RESULTS

A. COST ALLOCATION PROCEDURE

Cost allocation for disease costing was done under three headings.

- Patient based treatment cost

For each disease or procedure considered in this component, the direct cost comprised cost of consumables or time that was spent entirely on the patient (e.g. drugs, surgical consumables and medical officers' time)

- Hospital stay cost

This element comprised the cost of accommodation for a patient in the ward. This was previously estimated in Base Hospital Kuliyaipitiya and Teaching Hospital Kurunegala. Unit cost was calculated for each ward as the final step of the step down costing procedure. Items used in this calculation were salaries of nursing and paramedical staff, cost of electricity and water and recurrent and overhead costs. The cost estimated for Teaching Hospital Kurunegala was approximated to the Colombo North Teaching Hospital, Ragama.

- Paramedical cost

This comprised the cost of investigations performed on the patient and the cost of management of a patient in the operating theatre. Unit cost of investigations was estimated using the cost for each para-medical centre (e.g. Laboratory, X ray Department, Electrocardiography Department) calculated in the second step of the step down procedure and the number of investigations performed. Cost of using the operation theatre per patient was calculated considering the following:

- Unit cost of the operation theatre (calculated in the second step) and time spent in the operation theatre per patient
- Cost of the drugs and surgical items consumed by the patient
- Cost of the time spent by medical officers (surgeon, anaesthetist etc.) per patient

B. DISEASE SPECIFIC COSTING

B.1 ACUTE SEVERE ASTHMA

Forty subjects fulfilling pre-determined selection criteria were recruited for estimating the cost of management for acute severe asthma from each of the three hospitals.

In Base Hospital Kuliyaipitiya (BHK) and Teaching Hospital Kurunegala (THK) the study population was based on Bed Head Tickets of patients treated between 1st January and 30th June 2006. The study population in Colombo North Teaching Hospital (CNTH), Ragama, was actual patients receiving treatment between 15th September and 30th November 2006. Both study populations fulfilled the same criteria. The comparison of the average cost

incurred for treating a patient with acute severe asthma in the three hospitals is given in **Table 4-16**.

The average duration of hospital stay for patients with acute severe asthma was 4 days in THK and 4.3 days in BHK while at CNTH the average duration of stay was 6.9 days. This contributed to the cost being highest in CNTH. Cost of accommodation was the largest contributor to the total cost. Cost of nebulisation of patients accounted for approximately 8-10% of the total cost. A higher number of cost components have been incorporated into the management of a patient in CNTH as compared to the other two hospitals (e.g. procedures such as pulse oximetry and urinary catheterization). More technologically advanced investigations like echo-cardiogram also contributed to the higher cost observed at CNTH.

TABLE 4- 16: COST OF TREATING ACUTE SEVERE ASTHMA

Cost Component	Average Cost in LKR (% share of total)		
	BHK	THK	CNTH
Accommodation	2859.10 (73.7)	1747.63 (69.4)	3015.30 (61.1)
Medical Officers' time	174.07 (4.5)	225.06 (8.9)	224.95 (4.6)
Nebulisation	424.31 (10.9)	192.84 (7.7)	536.73 (10.9)
Urinary catheterisation	-	-	1.74 (0.0)
IV fluids	45.10 (1.2)	49.28 (1.9)	86.76 (1.8)
Drugs	212.15 (5.5)	180.05 (7.1)	393.85 (8.0)
Electrocardiogram	15.00 (0.4)	4.70 (0.2)	27.03 (0.5)
Chest X ray	53.07 (1.4)	19.60 (0.8)	161.70 (3.3)
Echo-cardiogram	-	-	18.30 (0.4)
Laboratory investigations	82.05 (2.1)	100.30 (4.0)	410.05 (8.3)
Pulse oximetry	-	-	22.13 (0.4)
Physiotherapy	12.60 (0.3)	-	34.30 (0.7)
Total	3877.45 (100)	2519.46 (100)	4932.84 (100)

B.2 ELECTIVE LOWER SEGMENT CAESAREAN SECTION (LSCS)

The total sample for costing elective lower segment caesarean section consisted of 120 subjects. In BHK and THK data extraction was done from BHTs of patients who underwent elective LSCS and conformed to pre-determined inclusion criteria. In CNTH 40 patients who underwent elective LSCS and fulfilled the inclusion criteria were recruited and studied prospectively.

The average duration of stay in BHK, THK and CNTH were 7.3, 7.9 and 6.6 days, respectively. The cost of an elective LSCS was highest in THK. Cost of accommodation was highest in BHK and lowest in CNTH in line with average duration of stay. Operation theatre overheads and the cost of medical officers' time in the operating theatre were lowest in BHK. Cost of Cardiotocogram, ultra sound scan and the drugs administered in the ward were higher in BHK than at the other two institutions.

TABLE 4- 17: COST OF ELECTIVE LOWER SEGMENT CAESAREAN SECTION

Cost Component	Average Cost in LKR (% share of total)		
	BHK	THK	CNTH
Accommodation	4603.75 (50.3)	3412.80 (36.2)	2840.40 (34.3)
Medical Officers' time	342.06 (3.7)	442.24 (4.7)	442.35 (5.4)
Operation theatre overheads	1933.88 (21.1)	3787.00 (40.2)	3247.13 (39.3)
Pre-medication	34.14 (0.4)	1.21 (0.0)	2.80 (0.0)
Anaesthesia	20.24 (0.2)	54.60 (0.6)	43.66 (0.5)
Drugs (operation theatre)	115.57 (1.3)	47.60 (0.5)	71.43 (0.9)
Medical Officers' time (operation theatre)	811.20 (8.9)	1048.80 (11.1)	1048.80 (12.7)
Nebulisation	-	2.60 (0.0)	-
Urinary catheterization	59.52 (0.6)	69.50 (0.7)	66.07 (0.8)
IV fluids	141.98 (1.5)	175.12 (1.9)	155.65 (1.9)
Drugs (ward)	370.50 (4.1)	47.30 (0.5)	138.77 (1.7)
Cardiotocogram	139.40 (1.5)	108.74 (1.1)	73.95 (0.9)
Ultra sound scan	516.80 (5.6)	94.20 (1.0)	-
Laboratory investigations	72.45 (0.8)	137.10 (1.5)	137.18 (1.6)
Total	9161.49 (100)	9428.81 (100)	8268.19 (100)

B.3 ISCHAEMIC HEART DISEASE

Forty BHTs satisfying the pre-determined selection criteria were selected from BHK and THK and the data were extracted for estimating the cost of management of ischaemic heart disease. Only 39 subjects were eligible from the sample drawn in THK, resulting in a total sample of 79.

In both hospitals the selected Bed Head Tickets were of patients treated between 1st January and 30th June 2006. The average cost incurred for treating a patient with ischaemic heart disease in the two hospitals is given in **Table 4-18**.

The average duration of hospital stay for patients with ischaemic heart disease was 3.7 days in THK and 5.4 days in BHK. The average total cost of treatment was higher in BHK. A higher average cost of accommodation, nebulisation, IV fluids, drugs, laboratory investigations X ray and ECG per patient were observed in BHK. Average cost of the medical officers' time per patient was higher in THK, Urinary catheterization and physiotherapy, the additional procedures performed in BHK accounted for only about 0.1% of the total cost.

TABLE 4- 18: COST OF TREATING ISCHAEMIC HEART DISEASE

Cost Component	Average Cost in LKR (% share of total)	
	BHK	THK
Accommodation	3452.00 (76.1)	1524.62 (62.1)
Medical Officers' time	252.0 (5.6)	326.87 (13.3)
Nebulisation	106.07 (2.3)	9.72 (0.4)
Urinary catheterisation	3.13 (0.1)	-
IV fluids	67.05 (1.5)	57.11 (2.3)
Drugs	335.07 (7.4)	301.80 (12.3)
Electrocardiogram	176.1 (3.8)	124.13 (5.0)
ECG monitoring	3.5 (0.1)	-
X ray	24.0 (0.5)	5.03 (0.2)
Laboratory investigations	117.30 (2.6)	108.92 (4.4)
Physiotherapy	1.40 (0.0)	-
Total	4537.62 (100)	2458.20 (100)

B.4 ACUTE MYOCARDIAL INFARCTION

The cost of treating acute myocardial infarction was studied prospectively in a sample of 40 patients who presented with the condition at CNTH, Ragama. They were selected based on the pre-determined inclusion criteria. All subjects were treated in hospital between 15th September and 30th November 2006.

The average duration of stay was 6.9 days. The total cost of management was Rs.7571.42, of which accommodation cost (36.3%) and drug cost (34.7%) were the largest components. Cost of laboratory investigations was Rs.889.43 amounting to 11.8 % of the total cost. The details are given in Table 4-19.

TABLE 4- 19: COST OF TREATING ACUTE MYOCARDIAL INFARCTION IN CNTH

Cost component	Average cost in LKR (% share of total)
Accommodation	2750.00 (36.3)
Medical Officers' time	326.90 (4.3)
Nebulisation	19.42 (0.3)
Electrocardiogram	213.85 (2.8)
Urinary catheterization	3.47 (0.0)
ECG monitoring	27.03 (0.4)
X ray	161.70 (2.1)
Ultra sound scan	54.90 (0.7)
Echocardiogram	366.00 (4.8)
Laboratory investigations	889.43 (11.8)
Drugs	2621.76 (34.7)
IV fluids	136.96 (1.8)
Total	7571.42 (100)

B.5 SURGICAL EXCISION OF BENIGN BREAST LUMP

The cost of surgical excision of benign breast lump was studied prospectively in a sample of 40 patients operated at CNTH,

Ragama, between 15th September and 30th November 2006. They were selected based on the pre-determined inclusion criteria.

The average duration of stay was 2.2 days. The total cost of management was Rs.5371.04. Operating theatre overhead cost was the largest component amounting to Rs.3517.50 (65.5%). Cost of accommodation accounted for 18.4% of total cost. The cost of the time spent on the patient by the medical officers in the operating theatre (7.3% of the total cost) far exceeded the cost of time spent on the patient by medical officers in the ward (2.7% of the total cost) (**Table 4-20**).

TABLE 4- 20: COST OF SURGICAL EXCISION OF BENIGN BREAST LUMP IN CNTH, RAGAMA.

Cost component	Average cost LKR (% share of total)
Accommodation	990.13 (18.4)
Medical Officers' time	143.33 (2.7)
Operation theatre overheads	3517.50 (65.5)
Pre-medication	5.30 (0.1)
Anaesthesia	136.94 (2.5)
Medical Officers' time (operation theatre)	393.30 (7.3)
Electrocardiogram	10.57 (0.2)
X ray	14.70 (0.3)
Laboratory investigations	110.63 (2.1)
Drugs	8.83 (0.2)
IV fluids	39.81 (0.7)
Total	5371.04 (100)

4.3.7 DISCUSSION

This cost analysis aimed to develop a comprehensive methodology to estimate the cost of treating diseases and carrying out surgical procedures. In addition to costing disease management for the selected diseases/conditions, the study also developed appropriate BHT data extraction forms and cost collation and time study procedures.

Cost estimates were derived for the management of acute severe asthma and elective LSCS three hospitals. Although costing at BHK and THK was retrospective while costing at CNTH was prospective, it is possible to compare the three sets of cost estimates. Cost of treating a patient with acute severe asthma was highest at CNTH. The longer duration of stay (nearly three days more than at the other two hospitals) resulted in a higher accommodation cost. Due to the longer duration of stay, the cost of drugs was also higher. These findings may suggest that the patients treated at CNTH, though identified based on similar criteria, may have been more ill than the patients at the other two hospitals. The higher cost of investigations, ECG, X-ray and intravenous fluids observed in the cost comparison also supports that impression. Being a larger tertiary care hospital and a referral centre

for a larger geographical area, it is possible that the type of patients admitted at CNTH, are different from the patients at BHK and THK in terms of severity of illness. Availability and use of more resources for management of a patient in CNTH, could also have contributed to the higher cost.

Comparing the costs between BHK and THK, it is noteworthy that the accommodation cost in BHK is higher despite a shorter average duration of stay. The costs of nebulisation, drugs, ECG and X-ray are also higher. The underlying reasons need to be carefully considered for improving the efficiency of hospital management at BHK. Being a Teaching Hospital, the number of medical officers attending to a patient in a medical ward may be higher in THK. This explains the increased cost of medical officers' time.

Cost of conducting an elective lower segment caesarean section (LSCS) is highest at THK, which also records a longer duration of stay. The operation theatre overheads and cost of anaesthesia is higher in THK. Cost of performing the surgery is approximately the same between THK and CNTH. This may be due to the proxying of hospital management cost at CNTH by the cost at THK. Cost of drugs administered in the operation theatre in CNTH is comparatively higher. This could be due to availability or local purchase of more expensive drugs at CNTH or differences in management protocols used at the two hospitals. The consistently high accommodation cost reported from BHK has to be considered in the context of future planning.

Costing of treatment for ischaemic heart disease was carried out at BHK and THK. The total cost of treating a patient at BHK is about 85% higher than in THK. The greater cost of accommodation results in a significantly higher total cost. The difference in the cost of nebulisation between the two hospitals is about 11 fold.

Acute myocardial infarction is an acute life-threatening emergency. The hospital stay is longer for this condition, and therefore the cost of accommodation contributes to a large percentage of the total cost of treating the disease. First-line drugs used for management of this condition are also expensive. Investigations such as ECG may be done many times during the hospital stay and more resources may be spent on monitoring the patient's condition.

Cost estimation of acute myocardial infarction and the surgical excision of breast lumps were done only for CNTH. While comparison is not possible in these two cases, they provide useful insights into the relative cost of the different elements of treatment.

Surgical procedures are relatively more expensive than medical conditions of equal gravity because of the use of the operation theatre and related facilities. We have estimated the cost of a surgical excision of a benign breast lump, one of the most simple and straightforward surgical procedures. For this procedure, the average duration of

hospital stay is about 2 days, so the cost of accommodation is low. The cost borne for anaesthesia and the cost of medical officers' time are also low due to the short duration of the surgery. Operation theatre overheads however constitute a large percentage of the cost.

4.3.8 CONCLUSIONS AND THE WAY FORWARD

The objectives of this study was to determine the costs incurred by the hospitals/state health sector for the treatment of selected diseases; and the demonstration that the step down hospital costing methodology could be adopted alongside disease specific costing to provide the basis for more generalized disease management costing.

The cost analysis used in this study had a number of limitations. For instance personnel cost specific to the patient suffering from a selected illness was estimated only for medical officers. Cost of the time spent on the patient by nursing and para-medical staff were not disaggregated by disease or activity but valued as part of hospital stay costs. Similarly cost of maintaining paramedical cost centres derived from the step down method were directly adopted in estimating the unit cost of disease management which resulted in. all laboratory investigations being assumed to cost the same rate. Future work in this regard could be carried out on a sample of patients to assess the deviation that occurs through aggregation when costing paramedical procedures.

The qualifications and the experience of different grades of medical officers (Specialist, Grade medical officers, intern medical officers) were also not taken into account in valuing the time spent by doctors. This masks the impact of differences in staff seniority and quality on costs. Greater attention to staff profiles would enhance future costing comparisons across different levels of hospital.

The cost accounting executed in THK and BHK used the current financial accounting results, so depreciation of the building, other facilities, and the equipment is not included. Therefore, an actual unit cost (especially, unit cost of the surgery) is more than the unit cost reported in this estimate.

This attempt at developing a methodology for costing diseases can be further improved if future studies are designed taking these issues into consideration. In the presence of a comprehensive costing system in hospitals, costing disease management needs to become a routine task in the future.

In the absence of disease management protocols, there is a considerable variation in management of the same disease at different centres. Though treatment of the patient is influenced by many factors that cannot be standardised, availability of a protocol will be helpful to manage patients rationally and efficiently. This study concludes therefore that immediate action should be taken to devise a

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set of protocols for the treatment of at least all the major diseases/conditions (defined both in terms of epidemiological burden and economic burden to family and nation) afflicting the county's population.

All will contribute in the future to the development of a comprehensive framework for the costing of disease management, in line with objective of evidence based decision making. With the development of standardised disease management protocols this could further lead to the development of benchmark costing of protocol based disease management