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Medical Science

COSTING OF CTVS- ICU ON BASIS OF EXPENDITURE INCURRED PER BED PER DAY

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ABSTRACT Hospitals are "precious" because they save precious lives. However, due to resource limitation, its cost-benefit value also needs to be ascertained in monetary terms.

Aim To arrive at the cost of CTVS- ICU on basis of expenditure incurred per bed per day.

Objectives 1.To identify various costs centers involved in care of CTVS ICU patients.

2. To identify all direct and indirect cost associated with above cost centers.
3. Based on above, to estimate cost on each ICU bed in CTVS ICU at Superspeciality Hospital

The direct cost contributes to an extent of 92 % in the overall patient care and indirect cost to an extent of just 8 %. This shows a good resource allocation system as majority of the expenditure is being made for the direct benefit of the patient and is contributing directly towards patient well-being. **The total cost per bed per day in CTVS ICU is Rs. 12,623.**

KEYWORDS : ICU , Costing , Hospital

Introduction

Critical care is an expensive care and accounts for 15-20% [1] of the hospital budget**. It is thus very important to accurately assess the cost of intensive care.** This knowledge of economics is essential to increase the economic efficiency as well as to evaluate the cost effectiveness of care.

The percentage of critical beds at present in large teaching hospitals is around 5-8 %[1] but due to increase in the number of geriatric population as well increase in the prevalence of non communicable diseases there is a strong need to increase the number of ICU beds to at least 10% of the total hospital beds correct estimation of cost is thus required for allocation of the resources.

Very few publications address the subject of intensive care costs. Furthermore, fundamental problems stem from both the different costing methods employed by individual studies [2,3] and the diversity of the case-mix of patients. This makes valid comparisons of findings in different studies a difficult task.

One of the few studies undertaken by Reis Miranda et al in 1995 where a non-random sample of 88 ICU in 12 European countries found that only 14 (in 5 countries) reported the presence of a cost accounting system and only 38 ICU directors indicated that they had some knowledge on the cost per bed per day in their ICU [4,5].

Aim & Objectives

Aim

To arrive at the cost of CTVS- ICU on basis of expenditure incurred per bed per day**.**

Objectives

1. To identify various costs centers involved in care of CTVS ICU patients.
2. To identify all direct and indirect cost associated with above cost centers.
3. Based on above, to estimate cost on each ICU bed in CTVS ICU at Superspeciality Hospital

Methodology

Place of study

The study was conducted at the All India Institute of Medical Sciences, cardiothoracic Centre in CTVS ICU.

Time period

The study was carried out for a total period of Two months Jan 2011 to Feb 2011 as per following schedule.

1. Data collection -01 months
2. Analysis of data and writing of document - 01 months

Study sample

CTVS ICU A was selected for the study, it has 21 beds. These 21 beds were considered to be an appropriate sample and better representation of patient mix consisting of 16 adult beds including 2 isolation beds and 5 NICU beds.

Collection of data and analysis

Data was collected from key informants during the course of the study as follows:

a. Information was collected from Faculty, DNS, Sister I/C regarding bed strength, types of cases, consumables required in the ICU, inventory of the ICU, blood & blood products requirement.
b. Information regarding air conditioning expenditure, electrical expenditure, and building costs was taken from engineering department.
c. Value of equipment, surgical, medical and general stores was obtained from respective store officer.

Total cost incurred in the management of CTVS ICU A was calculated as mentioned below: -

Apportioning

Manpower

Salaries of the providers of health care i.e. doctors, nurses, technicians, group C & D staff who were involved in patient's management was taken. The monthly remuneration based on the gross pay of each category of staff was apportioned. Apportioning was based on information provided by key informant regarding the percentage time involved in direct and indirect patient care activity.

The salary of faculty and resident was apportioned as per their time spent for the patient care in CTVS ICU. Salary of nurses, group C and D categories of staff involved in the patient care in CTVSICU and security was apportioned for the final calculation of cost.

Material cost

Medicines/ Disposable items/ Fluids monthly consumption of consumables was recorded from the indent books and estimate thus arrived was used in the calculations.

Investigation cost

The radiological, laboratory and other investigations were calculated

as per the AIIMS OPD rates prevalent to date.

Manifold Cost

Cost of gas supply to CTVS ICU from the manifolds room.

Cost of diet: Diet was not accounted since all are post op cases on IV/ parenteral diet.

Cost of materials from general store items: Complete months consumption details were analysed from the indent records of the ICUs store and the store to find the average cost of the materials from each store and was apportioned towards each bed per day.

Cost of equipment: The cost of equipment used on these patients was calculated. The annual depreciation @10% of the capital cost and comprehensive equipment maintenance @5% of capital cost annually (Tata Consultancy Services) was calculated and apportioned to each bed per day.

Cost of CSSD and Laundry: The cost of all of these services has been calculated based on the studies carried out by department of hospital administration and inflation was also taken into account.

Overheads

Building: The area occupied by ICU was noted down. The capital value building was calculated based on CPWD rates. Assuming life of building to be 100 years, depreciation @ 1 % of the capital value was taken to arrive at the cost of the building. The cost of building maintenance were taken and then final cost of the building was calculated (capital value & maintenance cost). These costs were apportioned to each I CU bed.

Electrical consumption and fixed electrical assets: Total electrical expenditure of CN centre was obtained from the past monthly records and was apportioned as per the bed strength of the ICU-A.

Water: Using the thumb rule of 500L per bed and the rate as given on the Delhi Jal Board website the cost of water will be calculated.

Central A.C.: The cost of its installation, operation, maintenance was taken into consideration.

OBSERVATION AND DISCUSSION

The cost of ICU care in a tertiary care centre in India (in 1991) was reported to be Rs. 3200 per patient ($167.70). Staffing, intravenous fluids, and drugs accounted for 75% of the cost of ICU care, whereas 15% accounted for laboratory investigations and 6.9% for disposable.[6]

Critical care beds in the large public teaching hospitals generally constitute 5-8% of the total bed· strength. At advanced centers in large cities, the ICU bed strength varies between less than 5% of the total hospital beds in majority of hospitals; to near 10% in selected few hospitals.

There appears a strong need to increase the ICU beds to at least 10% of total beds in all hospitals; and even up to 15-20% in some leading public as well as private tertiary care centers.

Manpower expenditure

Expenditure on Faculty and Residents

Everyday faculty conducts two rounds of CTVS ICU A along with senior resident and sister in charge. First round is held in the morning and second round in the evening after OT. On an average one hour in morning and one hour in evening is consumed on rounds.

The Senior Resident from CTVS and Anesthesiology devote full time in the ICU, hence the total pay for the day has been taken into account for patient care.

Sr No	Designation	Gross Salary per month	No. Faculty/SR
1	Professor	1,55,659	3
2	Assoc. Professor	1,48,507	4
3	Asst. Professor	1,23,389	-
4	Senior Resident	60,094	01 CTVS SR and 01 Anaes SR for twenty four hour

Table 1: Salary of faculty and resident

Cost of faculty = (3 Prof X 1, 55,659) + (4 Assoc Prof X 1, 48,507) = Rs. (4, 66,977 + 5, 94,028) = Total Monthly Pay of faculty i.e. Rs.10, 61,005 Pay of Faculty per day = Total Monthly Pay/24 working days= Rs.10, 61,005 /24 =Rs. 44,208 per day The working hour is 8 hours per day = Rs. 44,208/8= Rs. 5526 per hour for all faculty Average cost of one faculty per hour = Rs. 5526/7 (No. of Faculty) = Rs.614.00 The apportioned cost of faculty per day = total cost of Faculty per hour x 1 hour (morning round) + total cost of Faculty per hour x 1 hour (Evening round) = **Total cost of Faculty per hour x 1 hour x 2 = Rs 614 X 2= Rs.1228/-…… (A1) Cost of 2 Senior Resident per day** = 2 x Rs. 60,094 = Rs. 1, 20,188 per month. Cost of 2 Resident per day= Cost of 2 Senior Resident per month / 24 = Rs. 1, 20,188/24 = Rs. 5007.80 per day (one working day being of 8 hours) Cost of 2 Resident per hour = Rs. 5007.80/8= Rs. 626/- per hour. **Cost of residents (CTVS & Anesthesiology) per day = Rs. 626 X 24 = Rs. 15024/-... (A2)Expenditure on nursing staff in CTVS – ICU's**

Sr No	Designation	Gross Salary per month	No. employees	Total Monthly expenditure (In Rs)
1	DNS	48,764	1*(Same for ICU and OT,07.30-3.30)	12,191 (25 % of the time devoted in ICU)
2	ANS	43,282	02(07.30-3.30)	86,564
3	Sister I/C	34,431	02(07.30-3.30)	68,862
4	Sister Grade I	33,601	14	4,70,414
5	Sister Grade II	32,234	48	15,47,232
	Total			21,85,263

Table 2: Cost on nursing staff in CTVS – ICU

Total expenses on nursing salary per day = Rs. 21, 85,263/24 working day = Rs. 91,052.62 per day …… (B)

Expenditure on physiotherapist in CTVS – ICU's

Daily expenditure = Rs. 26,743/24 working days = Rs. 1114/- per day
Hourly expenditure = Rs. 1114/8 = Rs. 139 per hour

Expenditure for physiotherapist 24 hrs = Rs. 139 X 24 = Rs. 3,343 per day. ……(C)

Expenditure on group – D staff in ICU's

Daily Expenditure Rs. 2, 59,785/ 24 working days = Rs. 10824.40
Expenditure per hour = Rs. 10,824.40 / 8 = Rs. 1353

Expenditure on group D staff per day = Rs.32,473.00 …… …….. (D)

Security

The average monthly security bill of CN Centre is Rs. 7,50,000 and the bed strength of CN centre is 411 (CTC – 169 + NSC – 166 + CNT – 63 + 15 day care in cardio).

Cost per day per bed = 7,50,000/ (30 x 413) = Rs. 60.53 = Rs. 60 per bed per day.

Cost for Security for ICU – A per day = 60X21= Rs.1260/day …… …… (E) Total Manpower Cost per day for the CTVS ICU: = A1+A2+B+C+D+E (Details as above)= Cost of faculty+ Cost of residents (CTVS & Anesthesiology)+ Total expenses on nursing salary+ Expenditure for physiotherapist+ Expenditure on group D staff+ Cost for Security = Rs. 1,44,380.62/-

Drugs & disposables

The drugs and disposable consumed were observed and the rates were taken from the respective stores.

Value of all indents supplied from Medical Stores, Surgical Stores & general stores***The per day cost of drugs and disposables store = total cost of above / 30 = 4, 75,227.99 / 30 = Rs. 15,840.93/day.***

Radiological and laboratory investigations

The radiological and laboratory investigation cost

Total cost per day for Radiology and Laboratory = Rs. 1200 + Rs. 9,492 per day +24,400 =35,092 per day

General stores

The cost of general stores has been taken from the Rate Contract of respective items from Neuroscience Centre and the total consumptions have been taken from indent books.

Cost of the item consumed in three months = Rs 2, 89,671

Consumption per day = 289671/ 90 = Rs. 3218.56 per day

Stationery
Cost of the item consumed in three months = Rs 85,987
Consumption per day = Total consumption / 90
= 85,987/90
= Rs. 955 per day

Blood transfusion
Cost per day on blood products = Rs. 14,28,140/ 30= Rs. 47604.
Cost incurred per processed blood product =RS 1414 as per thesis submitted by Dr Shalini Bhalla Department of hospital Administration AIIMS in the year 2009 in dept of hospital administration.

Linen
Cost of Linen per day per bed: Rs. 14.35/-
Cost of Linen per day for all beds = Rs. 14.35 X 16 = Rs. 229.6

LAUNDRY SERVICES
As per study done in the Dept. of Hospital Administration by Dr. Patnaik, the cost of laundry per kg of linen is Rs.23.22

Hence the cost per day for ICU-A (16 beds, excluding NICU beds) = Rs 23.22 X 42.90kg= **Rs. 996.18 per day**

CENTRAL SUPPLY STERILE DEPARTMENT
In a study conducted by the Dept of Hospital administration in 2009 at AIIMS it was found that cost of sterilization is Rs. 33.9 per bed per day.
Total cost per day = Rs. 33.90 X 21 = Rs. 711.90

MANIFOLD
Cost of manifold, per bed per day to be Rs.97.50 in 2001 as per study in department. The price index in 2001 was 426 and current index is 711 (Year -2011)

Accordingly after adjusting inflation it will be the present cost of manifold = manifold cost x present index / 2001 index = 97.50 x 711/ 426 = **Rs.162.80 per bed per day**.

Total beds (including NICU beds) = 21 **Total Cost = Rs.3418.80 per day for ICU – A.** There are total 26 panels in the ICU-A. Each panel has oxygen 02 points, Low vacuum 1, High vacuum 1, Medical Air 1.

BUILDING AND MAINTENANCE
CONSTRUCTION COST
As per CPWD manual, cost of construction was Rs. 24223/ sq. mt in 2007, CII (2007) = 51 In 2011 (CII = 711) cost of construction = Rs. 24223 X (711/519) = Rs.33184 per sq. mt. For CTVS ICU-A (Area = 625 sq. mt.), Cost = 625 X 33184 = Rs. 207, 40,000

Cost per year (depreciation = 1 %), Cost of Construction = Rs. 2, 07,400

MAINTENANCE COST
As per CPWD manual, annual cost of maintenance was Rs. 15/ sq. mt in 1987, CII (1987) = 140 In 2011 (CII = 711) annual cost of maintenance = Rs. 15 X (711/140) = Rs.76.18 per sq. mt.

For CTVS ICU-A (Area = 625 sq. mt.), Cost = 625 X 76.18 = Rs. 47,612.50 Total cost in once year = Rs. 2, 07,400 + Rs. 47,612.50 = Rs. 2,55,012.5 Cost of maintenance per day = Rs. 698.66

ELECTRICITY EXPENDITURE
Electricity bill for the month of Dec-2010 was Rs. 33, 87,426This includes CN centre & CN Tower – Rs. 17, 31,098 & Rs. 16, 56,382 respectively. Daily electricity cost = Rs. 1, 09,271.8 Cost /Bed/Day =1, 09,271.8/411= Rs.265.86For 21 Bed of ICU-A

Cost per day on electricity = Rs.265.86x21= Rs.5583.23
This cost includes general lighting as well as all medical appliances and air conditioning expenses.

COST OF AIR CONDITIONING
Installation Cost Capacity of AHU: 55 TR Cost of Installation: Rs. 68,000 per TR (Includes cost of piping, chiller and AHU coil) Total cost of installation: Rs. 68,000 X 55 = Rs. 37, 40,000

Depreciated Value: Rs. 3, 74,000/- (Life of AHU= 10 years) Operation & maintenance cost: AMC for CN centre is Rs. 100, 00000 and TR capacity is 2400 Cost of AMC per TR = 100, 00000/2400= Rs 4167/TR Cost of AMC for ICU – A = Rs.4167 X 55 = Rs.2, 29,185/- Total Annual Cost = Rs.3, 74,000 + Rs. 229185 = Rs. 6, 03,185/- Cost per month = Rs. 6, 03,185/12 months = Rs. 50,265.40

Cost per day = Rs. 50,265.40/30 = Rs. 1675.51

WATER CONSUMPTION
As thumb rule water consumption is 500 liter per day per bed. The Jal board rate is Rs. 10 per kilo liter. So the rate per bed is Rs. 5 per bed per day.

Total cost per day = Rs. 5 X 21 = **Rs. 105.**

EQUIPMENT
Total value of equipment = Rs. **1,64, 44486/-**
Total cost of equipment per year = Rs. **16, 44,448/-**
(With **Depreciation = 10%**)
Monthly cost = Rs. 137037
Cost per day = Rs. 4567.90 for ICU – A of 21 beds.
Equipment list: Cost on equipments in CTVS ICU A : Rs. 1,64, 44486/- **Summary of expenditure on cost centers is as follows**

Sr. No.	Cost Centers	ICU (Rs per day)
1	Faculty	1228
2	Senior Residents	15024
3	Nursing services	91053
4	Physiotherapist	3343
4	Group – C & D Employee	32473
5	Security	1260
6	Drugs & Disposables	15841
7	Radiological & Laboratory	35092
8	General store items	3219
9	Stationary	955
10	Blood products	47604
11	Linen	230
12	Laundry Services	996
13	CSSD	712
14	Manifold Room	3419
15	Building Cost + Maintenance	699
16	Electricity	5583
17	A C Plant	1676
18	Equipment	4568
19	Water	105
	Total (for 21 beds)/day	***Rs. 2,65,080/day***
	Total per bed per day	***Rs. 12,622.857***

Table 3: Summary of cost centers

The various cost centres involved in patient care in the CTVS ICU and their proportion towards the total cost is summarized below:

1	Human resource	144381	54.46%
2	Drugs & disposables	15841	5.97%
3	Radiology & lab	35092	13.24%
4	General & stationary	4174	1.57%
5	Blood products	47604	17.95%
6	Linen, laundry, CSSD	1938	0.73%
7	Electricity, A/C , manifold, water	10783	4.06%
8	Building	699	0.26%
9	Equipment	4568	1.72%
		2,65,080	**100.00%**

Table 4 : Cost centers in the CTVS ICU

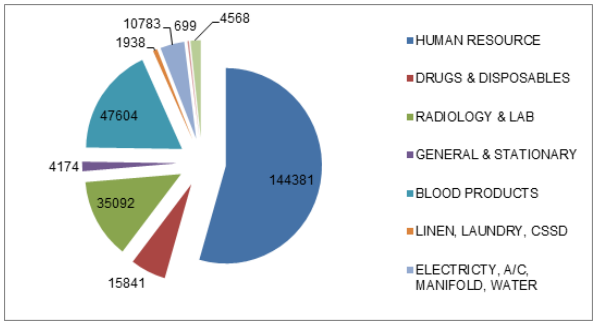

Fig 1: Cost centers in the CTVS ICU

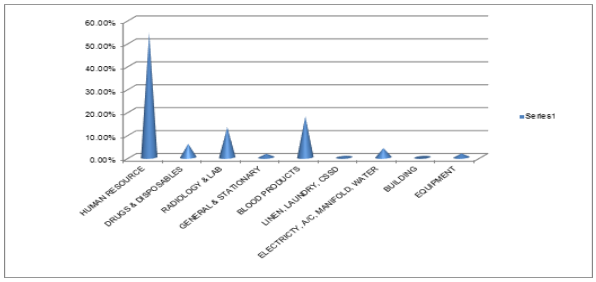

Fig 2: Cost centers in the CTVS ICU Graph

The three major cost centres are Human Resource, Blood Transfusion service and Radiology & Lab CTVS ICU-A.

The measure of direct and indirect cost for ICU-A

Direct	Cost	Percent share
Human resource	1,44,381	54.46%
Drugs & disposables	15,841	5.97%
Radiology & lab	58,942	13.24%
Blood products	47,604	17.95%
	2,66,768	**91.63%**
Indirect cost		
General & Stationary	4,174	1.57%
Linen, Laundry, CSSD	1,938	0.73%
Electricity, a/c, manifold, water	10,783	4.06%
Building	699	0.26%
Equipment	4,568	1.72%
	22,162	**8.36%**
Direct	**91.63%**	
Indirect cost	**8.36%**	

TABLE 5: DIRECT AND INDIRECT COSTS

The direct cost contributes to an extent of 92 % in the overall patient care and indirect cost to an extent of just 8 %. This shows a good resource allocation system as majority of the expenditure is being made for the direct benefit of the patient and is contributing directly towards patient well- being.

The aggregate cost of patient care – per bed – per day in the CTVS ICU is as follows:

Total (for 21 beds)/day	Rs. 2,65,080
Total per bed per day	Rs. 12,623

Table no. 6: Cost CTVS ICU per bed per day
The total cost per bed per day in CTVS ICU –A is Rs. 12,623.

CONCLUSION

With ever-increasing numbers of the patients and competing demand on the finances, this task becomes even more challenging. Resource generation by the public sector units has become a need of the time. From the study it has been concluded that the total cost per bed per day in CTVS ICU is Rs. 12,623. The three major cost centers for CTVS ICU are Human Resource, Blood Transfusion services and investigations.

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