CHAPTER 3

COST ANALYSIS
AND
EFFICIENCY INDICATOR
FOR HEALTH CARE
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Cost Analysis and Efficiency Indicators for Health Care

3.1] Introduction

Clinical care practitioners have the number of health related technologies in their hospitals to provide the best possible care for critically ill patients. In the current health care, increasing emphasis is being placed on cost reduction admitting only high risk patients to critical care units (CCU) may reduce hospital costs and charges without adverse clinical outcomes.

The increasing cost of modern medicine is a challenge. Health authorities and government try to reduce costs, or at least to reduce the increases in costs of health care. It is generally claimed that intensive care is very expensive. Intensive care cost is one of the largest components of inpatient care accounting. In the USA the sum of resources used for intensive care is estimated to be 1% of the Gross National Product, while it is less in European countries [24].

In recent decades, the continuous rising cost of healthcare has forced decision-makers to introduce cost-containment policies in several countries [1]. Resource consumption and the costs incurred as well as on the evaluation of the technology used and its impact on promoting health is now much more attentions.

Studies concerning unit cost analysis and hospital cost assessment as well as economic evaluation analyses regarding the cost of specific diseases and the effectiveness of medical interventions or treatments, have only recently been carried out by researchers although their findings are not taken into account in decision-making.

The economic analysis technique could substantially contribute to the assessment of resource consumption initially at microeconomic and later at macroeconomic level and thus to adoption of prospective payment.

Due to various factors, the cost of medical care has been increased rapidly. Therefore it is important to know regarding the actual cost of providing medical care especially the core services provided by the hospitals. The aim of this chapter is to carry out a cost analysis of ICU patients in the hospitals.
Cost accounting has become an essential part of health care management. The increasing healthcare costs have forced the health care managers to know the costs of different alternatives approaches to providing care. These costs can only be known if the organization has the knowledge and capability to measure costs. All health care managers, and not just accountants are becoming more aware of the importance of understanding as much as they possibly can about costs.

Given the outlined above, the purpose of our study is the analytical determination or resource consumption in a specific unit and for a specific disease patient group and also the benefits from the resources, this chapter attempts to investigate the hospitalization cost of patients with different diseases, who are admitted in the intensive care unit (ICU) of Yadgire hospital, the super specialty Hospital in Amravati District, Region of Maharashtra.

Two major avenues for increasing health benefits from scarce resources are

1. Increasing the efficiency and improving the existing health facilities and health programs and

2. Increasing the allocation of resources to those programs that are most cost-effective.

In order to increase the use of resources for more cost-effective and efficient services, every physician undertook a cost-effectiveness exercise.

**What is Cost Effectiveness Analysis?**

Cost-Effectiveness Analysis is a method for identifying interventions that achieve the greatest level of health impact per unit of expenditure. Effectiveness is typically measured in terms of improvements in health status. Various measures, including years of life gained through reduced mortality, Disability Adjusted Life Years (DALYs), and Quality Adjusted Life Years (QALYs) are used to assess effectiveness [28].

An important aspect of cost-effectiveness analysis is Cost Efficiency and that it can be decomposed into allocative (or price) efficiency and technical efficiency. A hospital is said to be technically efficient if a reduction in any input require an increase in at least one other input or a decrease in at least one output [27].
Technical efficiency is the extent to which the choice and utilization of input resources produce a specific health output, intervention or service at the lowest cost. Inefficiency of inputs can lead to high costs per unit of service delivered to patients. Technical inefficiency occurs when output is less than it technically possible with the mix of inputs used by the hospital [7].

Data Envelopment Analysis (DEA) is applicable to the measurement of cost and technical efficiency [27]. A technically efficient hospital may show cost inefficiency because, given input prices, it do not minimize cost.

Allocative efficiency measures the optimal distribution of resources among a number of competing uses.

To define costs and efficiency in hospitals, we undertook detailed costing studies for health facilities. This study presents results for the costing of Yadgaire Hospital at Amravati.

The study uses step-down analysis to cost hospital-based services in the hospitals. Efficiency indicators point to significant technical and economic inefficiencies [2]. It is observed that, most of the expenditures in the hospital are used to pay for salaries of personnel rather than optimal resources for drugs and medical supplies.

Major intra-hospital differences exist in costs per admission, total full time equivalent staff per bed, output per physician, bed turnover rate and bed occupancy rate.

The main objectives of the cost and allocative efficiency study of the Hospital are

- To define appropriate methodology for calculating the service cost.
- To increase the technical efficiency so that the cost studies are helpful for decision-making.
- Estimate the actual economic costs of services delivered for each diseases in the hospital.

Through the analysis we have to show that with better allocation of resources, major efficiency can be achieved.
Leftakis and Geitona [4] analyzed the result of the various facilities by comparing the range of cost for inpatient services.

3.2] Subjects and Methods

3.2.1] Study Population

The study population consists of 106 incidence patients who are hospitalized and prospectively enrolled in the hospital between January 1, 2005, and May 30, 2005. There is a rich ethnic distribution within this community, which consists of approximately 26,06,000 individuals.

3.2.2] Method

The study is carried out at the well-known hospitals in Amravati region and after a preliminary study the year for which the unit cost would be calculated was chosen as 2005. Clinical data were derived from patient's medical records while administrative, economic and other relevant data were derived from the hospital In charge.

Cost analysis based on the cost of personnel (Nursing, Ward boy, Guard Aya Bai Assistant doctor, Receptionist and auxiliary), cost of supplies (treatment procedure cost), cost of infrastructure (electricity, water, telephone etc), laundry cost.

The economic analysis did not include the cost of capital assets like buildings and equipments. The information routinely collected on patients in intensive care units (ICUs), that data determines the total cost for a given patient. Drug utilization was reported on per-patient basis, while drug costs were obtained from the hospital pharmacy. All the relevant information to cost is collected through patients bill and Administrative officer.

The actual medical variable cost per patient is computed from data on the total resources use, collected from the patients records plus pharmacy, laboratory. The method for arriving at the cost of services is based on the perspective study of the records of patients hospitalized in ICU, records of stores held on charge, consumables and drugs indented, and utilization records maintained in the ICU and also by interviews with the staff and supplemented by observational study. The functional relationships between the
non-ICU and the other departments were also studied, so that relevant cost data can be collected from the respective departments.

3.3] Distinct Phases of the study

The study is divided into four distinct phases. The phases are as under:

**Valuation of Hospital ICU**

During this phase all the input resources into the ICU are collected, to valuate the ICU as a cost center

**Valuation of the special services**

Once Valuation of Hospital ICU is determined, the next step is to consider the costs to the various special services. The costs that are directly traceable to the specialty center are attributed to that particular speciality service. Where the service function input resource, which are shared by the specialty services the same is required to be allocated on some logical and rational basis. The rational based on the function, service, or resource to be allocated, the cost driver identified like the number of patients, or on the basis of time that the specialty shared from the total period of time.

**Study of the utilization of resources**

Once the valuation of the cost is studied, and the appropriate and attribution of the costs to the special service is concluded, the next objective is to measure the utilization of resources, to determine a suitable measure of the utilization, which matches the services rendered. This measure would then act as a denominator to the special resources consumed or the resource input into the cost to calculate the unit cost of the service.

**Compute unit cost for service rendered and analysis**

The total input of resources is divided by the utilization of patients to arrive at the cost per patients for the service. Determination of each of the utilization in the thesis is as under

- Case or Diseases wise.
- Resource used.

The analysis of the cost of services is also done on other parameters to arrive at logical conclusions and make meaningful recommendations.
The tabulation of the collected data of the present investigation, for the sake of the convenience in their presentation, have been divided into following different sections, such as patients characteristics, different cost component like Personnel, Diagnostic tests, Laboratory test, Medication Supplies, Laundry services (laundry), Infrastructure (Lighting, phone), total Hospitalization Cost. All the relevant data to these sections are presented in the Appendix C (pp 129-154).

Patient’s characteristics and different cost component have assumed a greater significance in view of their relevance, importance and bearing for desirable change in the behaviour of an individual for the adoption of recommended technologies. In this context it is inevitable relating to those characteristics of the respondents, in the present study, is collected and the same has been presented in the different tables under respective categories.

3.4] Allocation of Costs

Economic costs are used for the purpose of this analysis. The Hospital is divided into different cost components based on the nature of service provided. The different cost components are Personnel, Diagnostic tests, Laboratory test, Medication Supplies, Laundry services (laundry), Infrastructure (Lighting, phone), and total Hospitalization cost.

Monthly expenditure on each head and the unit charges that service provided by the hospitals are mentioned in the Appendix B (pp 127-128).

3.5] Cost Categories

3.5.1] Personnel Costs

Staffs are allocated to five categories,

1. **Physicians:** Includes all medical doctors working in the hospitals

2. **Nurses:** Includes all nurses who graduated either from the school of nursing or from the high institute of nursing or trained.

3. **Technicians / Skilled Personnel:** Includes personnel with a university degree or a special skill. They include lab technicians, pharmacists.

4. **Administration:** Includes personnel performing administrative work.
5. **Unskilled personnel**: Includes all personnel working as Aya Bai, Guard and helper.

3.5.2) **Diagnostic Cost**

In this cost category, the cost allocated to diagnostic test are to be considered. X-ray and E.C.G. these tests are only performed in the hospitals and those are included in the diagnostic test services.

3.5.3) **Laboratories Cost**

Those Laboratories tests are performed in the hospitals are included in the Laboratory test services. Cost related to those tests are used for the analysis.

3.5.4) **Medication Supplies**

Whatever the medicine given to the patients along with the treatment procedures and their cost are considered for the cost analysis.

3.5.5) **Laundry services**

This includes laundry cost.

3.5.6) **Infrastructure cost**

This includes the costs of lighting and phone during the period of data collection from Jan 1, 2005 to May 31, 2005. (Appendix B)

3.5.7) **Other Doctors Charges**

In this head, sometimes the outside expert Doctors are called for the diagnosis, operation or surgery or any other purposes to provide better service. The patient has to pay these charges other than hospitalization cost. Therefore the hospitalization cost is obtained by subtracting other doctor's charges from the total cost.

The other Doctor charges is the sum of the emergency charges, other doctor charges and the cost of illness. The terminology of cost of illness is defined in the next chapter number 4 (section 4.3.1, pp 79)

For example the other Doctor charges for CNS patients, the emergency Charges in Rs is 500, the other doctor charges in Rs is 45750 and the cost of illness in Rs is 7812.

Therefore Other Doctor charges = Rs 500 + Rs 45750 + Rs 7812 = Rs 54062
For the RTA diseases the cost of illness are not defined because there is no time
the situation happens with the patient. Respective cost categories and there values are
consider from the Appendix C.

3.6] Efficiency Indicators

The study prepared some efficiency indicators in the hospital so that it will help
in taking decision to evaluate the level of performance.[2]

3.6.1] Occupancy Rate (O.C.C)

Measures the percentage of total available beds that are occupied by patient
during the study period.

\[
\text{Occupy bed} = \frac{\text{Study period days} \times \text{Total patient days of stay}}{\text{Total number of days that patients stay in ICU.}} \\
\text{OCC} = \frac{\text{Occupy bed} \times 100}{\text{Study period days} = 151}
\]

3.6.2] Turnover Rate (T)

Bed turnover rate (T): The average number of patient admissions per bed during
study period.

\[
T = \frac{\text{Total number of admissions}}{\text{Number of available hospital beds.}}
\]

3.6.3] Number of ICU patient Days per FTE Physician

Full-time equivalent (FTE) physician: FTE was calculated by dividing each
physician's work by specialty by the ratio of his/her work in outpatient clinics, inpatient
departments, operation theaters and the emergency unit

FTE physician for inpatient departments: The total number of physicians
working at inpatient departments and operating rooms.

FTE physician per bed: Measures the number of physicians working full-
time per bed for inpatient departments.

\[
= \frac{\text{Total number of physicians working at inpatient departments and}}{	ext{operating rooms}} \text{/ total number of beds.}
\]
3.6.4] Hospital Staff

The step-down technique is used to study an estimation of the total hospital staff working for particular diseases. But for the Yadgire Hospital, only 3 FTE physicians are available at any time other than main Doctors.

3.6.5] Number of FTE staff per Bed

The study uses the step-down technique to allocate the personnel of the ICU services departments. The average number of hospital personnel per bed is 1 and the number of FTE physicians per bed is 0.3 since the total bed in ICU are 10...

3.6.6] Number of Nurses per Physician

Measures the number of nurses working with a full-time physician.

\[ \text{Total number of nurses/total number of FTE physicians} \]

The average number of nurses per physician is 1. Since total numbers of nurses providing their service in the ICU are 3 and Physician are also 3.

3.6.7] Number of Admissions per FTE Physician

It is calculated on the basis of number of admissions for the particular diseases to the total number of FTE physicians. It is observed that, the accidental cases are more in ICU therefore admissions per FTE physician for RTA diseases are greater in number. The average number of patient admissions per full time equivalent physician during the study period is.

\[ \text{Total admissions/total number of FTE physicians} \]

3.6.8] Average Length of Stay by Diagnosis

There are many measures to assess ICU resource utilization. A simple and readily available measure is ICU length of stay (LOS). Cost analysis studies have found that the ICU cost per day per patient is remarkably consistent across most diagnoses [48]. Therefore, ICU LOS has been used as a important measure of resource utilization in the ICU [63].

The study measured the average length of stay for 7 diseases at Yadgari Hospital from January 2005 to May 2005. The data is collected from the admissions and discharge sheets of the hospital to assure the accuracy of results.
The mean number of days from admission to discharge for diagnosis and inpatient department, ALOS is calculated by using the formula

\[
ALOS = \frac{\text{Total number of inpatient days}}{\text{total number of admissions}}
\]

In general, average lengths of stay appear appropriate for many of the diagnosis. However, without further information about the severity of cases, it is not possible to assume that the patients are hospitalized appropriately.

3.7] Statistical Analysis

Richards [50] stated in his study for the economic evaluation, sample size is not specifically determined. A variety of data sources are used to acquire information about resources used, and relatively few patients had a complete set of such data. Hence, mean costs for each item of resources used are calculated and then aggregated to estimate the total cost per patient. Statistical testing is therefore not possible at the level of total resources used per patient. The mean is presented for descriptive purposes along with the standard deviation because the resources used data are highly positively skewed, for such skewed data, to interpreting standard deviation is used.

Statistical software likes SPSS 8.0, Sigma stat and Excel are used for analyzing the data collected. Continuous variables are expressed as mean ± standard deviation (SD).

3.8] Disease wise Specific Results

3.8.1] Central Nervous System (CNS)

General Characteristics of Patients

Table 15: Characteristics of CNS Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>8</td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>48.6±19.3</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>37</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>33</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>4±4</td>
</tr>
<tr>
<td>Average LOS in hospital</td>
<td>5±4</td>
</tr>
</tbody>
</table>

Source : (Appendix C, Table C1 pp. 129)
Cost categories:

Table 16: Cost Components of CNS

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>86250.00</td>
<td>37.89</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>2720.00</td>
<td>1.20</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>11350.00</td>
<td>4.99</td>
</tr>
<tr>
<td>Medication</td>
<td>61154.00</td>
<td>26.87</td>
</tr>
<tr>
<td>Supplies</td>
<td>65700.00</td>
<td>28.86</td>
</tr>
<tr>
<td>Laundry services</td>
<td>30.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>408.00</td>
<td>0.18</td>
</tr>
<tr>
<td>Total</td>
<td>227612.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C1 pp. 129-130)

Cost Analysis

- Other Doctor Charges: Rs 54,062.00
- Total hospitalization cost: Rs 2,27,612.00 - Rs 54,062.00 = Rs 1,73,550.00
- Total cost for this disease: Rs 1,73,550.00
  (9.3 percent of total cost of ICU patients)
- Cost per inpatient admission: Rs. 21693.85
- Cost per day: Rs 5259
- Average cost per bed: Rs 17355

Efficiency Indicators

- Total admissions: 8 (7.54 percent of total admissions)
- Number of beds: 10
- Average patient-days of stay: 33 (9.37 percent of total patient-days)
- Occupancy rate: 9%
- Bed occupy in days: 14
- Bed turnover rate: 0.8
- Average length of stay: 4.1
Department Staff

- Number of full time equivalent physicians: 3
- Average admissions per FTE physician: 2.6 (approximately 3)
- Average patient-days per FTE physician: 11
- Number of FTE physicians per bed: 0.3
- Number of nurses per FTE physician: 1

The cost of Rs 5259.09 per day is the lowest (figure 6, pp 76) of the ICU departments in the hospital due to the 8 numbers of admissions, the total duration of stay, 33 days. The ALOS rate (4.12) is the second highest after the P/A diseases at 5.

Personnel working in the ICU department only receive 37.89 percent of the total cost. (figure 4, pp 75) The highest percentage of Supplies costs, 28.86 for the inpatient ICU departments as compared with the other diseases, followed by Laboratory cost at 4.99 percent.

Medication accounted for 26.87 percent, of the total cost of admission. The occupancy rate 9% for this disease, it is second lowest in the hospital. The turnover rate is also low 0.8 due to the relatively long lengths of stay.

For this disease the number of admissions are relatively low. Therefore the admissions per FTE physician having 3 patients the highest number of admissions, 23 patients, is in the RTA diseases group.

The results calculated by step down method and comparing it with other diseases results, it is found that the hospital is less efficient for the this disease due to following reasons

- Low number of admissions i.e. 8 patients in 5 month
- Low turnover rate at 0.8 patients per bed.
- Low occupancy rate at 9% only.
- Patients /FTE physician is approximately 3 patients.
- High cost per admission. The ICU cost is the second highest of the inpatient departments at Rs 21,693.75 after P/A at Rs 28,615.00.
3.8.2] Cardio Vascular System (CVS)

General Characteristics of CVS Patients

Table 17: Characteristics of CVS Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>20</td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>59.6±12.6</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>79</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>55</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>3±2</td>
</tr>
<tr>
<td>Average LOS in hospital</td>
<td>4±2</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C2 pp. 131)

Cost categories:

Table 18: Cost Components of CVS.

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>168150.00</td>
<td>47.98</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>11500.00</td>
<td>3.28</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>6150.00</td>
<td>1.75</td>
</tr>
<tr>
<td>Medication</td>
<td>111272.00</td>
<td>31.75</td>
</tr>
<tr>
<td>Supplies</td>
<td>52300.00</td>
<td>14.92</td>
</tr>
<tr>
<td>Laundry services</td>
<td>75.00</td>
<td>0.02</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>1019.00</td>
<td>0.29</td>
</tr>
<tr>
<td>Total</td>
<td>350466.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C2 pp. 132-134)

Cost Analysis

- Other Doctor Charges: Rs 67976
- Total hospitalization cost: Rs 3,50,466 - Rs 67,976 = Rs 2,82,490.00
- Total cost for this disease; Rs 2,82,490.00

(15.16 percent of total cost of ICU patients)
- Cost per inpatient admission: Rs 14214.5
- Cost per day: Rs 5136.18
- Average cost per bed: Rs 28249

**Efficiency Indicators**
- Total admissions: 20 (18.06 percent of total admissions)
- Number of beds: 10
- Average patient-days of stay: 55 (15.34 percent of total patient-days)
- Occupancy rate: 16 %
- Bed occupy in days: 24
- Bed turnover rate: 2
- Average length of stay: 2.75

**Department Staff**
- Number of full time equivalent physicians: 3
- Average admissions per FTE physician: 6.6 (approximately 7)
- Average patient-days per FTE physician: 18.33
- Number of FTE physicians per bed: 0.3
- Number of nurses per FTE physician: 1

The turnover rate of 2 patients during study period is the second highest in the hospital. The average length of stay of 2.75 days is the lowest for ICU inpatient departments.

The CVS patients occupy the bed 24 days out of 151 days therefore the percentage of occupancy rate is 16 %.

High turnover and low ALOS lead to the lowest cost per day (Rs 5136.18). Personnel and Medication cost represent 47.98 and 14.92 percent of the total cost respectively. Diagnostic cost 3.28 percent is the lowest cost among all the diseases diagnostic cost.

The average admission per FTE physician is 6.6 patient which is the third highest after the HI and RIA diseases. The patient's days per physician is 18.33.
3.8.3] POISONS

General Characteristics of Patients

Table 19: Characteristics of POISON Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Of patients</td>
<td>11</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>29.7 ± 10.6</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>62</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>34</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>3 ± 3</td>
</tr>
<tr>
<td>Average LOS in hospital</td>
<td>6 ± 4</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C3 pp. 135)

Cost categories:

Table 20: Cost Components of POISON

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>76900.00</td>
<td>35.72</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>1760.00</td>
<td>0.82</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>5950.00</td>
<td>2.76</td>
</tr>
<tr>
<td>Medication</td>
<td>83781.00</td>
<td>38.91</td>
</tr>
<tr>
<td>Supplies</td>
<td>46300.00</td>
<td>21.51</td>
</tr>
<tr>
<td>Laundry services</td>
<td>42.00</td>
<td>0.02</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>560.00</td>
<td>0.26</td>
</tr>
<tr>
<td>Total</td>
<td>215293.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C3 pp. 136-138)

Cost Analysis
- Other Doctor Charges: Rs 84833
- Total hospitalization cost: Rs 215,293 - Rs 84,833 = Rs 1,30,460.00
- Total cost for this disease: Rs 1,30,460.00

(8.8 percent of total Cost of ICU patients)
• Cost per inpatient admission: Rs 11860
• Cost per day: Rs. 3837.05
• Cost per bed: Rs 13046

Efficiency Indicators
• Total admissions: 11 (10.37 percent of total admissions)
• Number of beds: 10
• Average patient-days of stay: 34 (9.65 percent of total patient-days)
• Occupancy rate: 10 %
• Bed occupy in days: 15
• Bed turnover rate: 1.1
• Average length of stay: 3.09

Department Staff
• Number of full time equivalent physicians: 3
• Average admissions per FTE physician: 3.6
• Average patient-days per FTE physician: 11.33
• Number of FTE physicians per bed: 0.3
• Number of nurses per FTE physician: 1

For the Poison disease have the lowest cost / day (Rs 3837.06) Occupancy rate is quite low 10 %, which is the third lowest occupancy rate after the 'other' diseases at 8 % and CNS at 9 %.

The average number of patient admissions per bed during study period is 1.1, which is similar to diseases 'other'. All the patients occupy the bed for 15 days during the study period since the turnover rate is quite low.

The cost per bed in this disease is Rs 13046, which is relatively low because of the low total cost of the diseases (Rs1, 30,460.00) since the numbers of beds are quite low, total 10 beds in the hospital.

Medication costs constitute 38.91 percent of total costs, the highest percentage cost in all inpatient diseases. Personnel costs accounted for 35.72 percent. This disease is the only one where medication costs were greater than personnel costs.
The numbers of nurses per FTE physician is 1. This is the lowest figure in the hospital. Step-down allocation of hospital staff shows that the total number of FTE staff for the ICU department is only 3, which is the second smallest number for the ICU department.

3.8.4] Road Traffic Accident (RTA)

General Characteristics of Patients

Table 21: Characteristics of RTA Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>23</td>
</tr>
<tr>
<td>Male</td>
<td>21</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>33.87 + 16.28</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>136</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>72</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>3 + 4</td>
</tr>
<tr>
<td>Average LOS in hospital</td>
<td>6 + 10</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C4 pp. 139)

Cost categories:

Table 22: Cost Components of RTA

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>277900.00</td>
<td>37.89</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>10280.00</td>
<td>1.20</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>5100.00</td>
<td>4.99</td>
</tr>
<tr>
<td>Medication</td>
<td>142020.00</td>
<td>26.87</td>
</tr>
<tr>
<td>Supplies</td>
<td>84000.00</td>
<td>28.86</td>
</tr>
<tr>
<td>Laundry services</td>
<td>87.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>1172.00</td>
<td>0.18</td>
</tr>
<tr>
<td>Total</td>
<td>520559.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C4 pp. 140-142)
Cost Analysis

- Other Doctor Charges: Rs 1,29,379.00
- Total hospitalization cost: Rs 5,20,559.00 - Rs 1,29,379.00 = Rs 3,91,180.00
- Total cost for this disease; Rs 3,91,180.00
  (21 percent of total expenditures of ICU patients)
- Cost per inpatient admission: Rs 17007
- Cost per day: Rs 5433.05
- Cost per bed: Rs 39,118

Efficiency Indicators

- Total admissions: 23 (21.69 percent of total admissions)
- Number of beds: 10
- Average patient-days of stay: 72 (20.45 percent of total patient-days)
- Occupancy rate: 20%
- Bed occupy in days: 31
- Bed turnover rate: 2.3
- Average length of stay: 3.13

Department Staff

- Number of full time equivalent physicians: 3
- Average admissions per FTE physician: 7.66
- Average patient-days per FTE physician: 24
- Number of FTE physicians per bed: 0.3
- Number of nurses per FTE physician: 1

This disease has the highest total cost in the hospital at Rs 3,91,180.00 the higher total costs are due to the following:

- High patient-days of stay.
- Total numbers of admissions 23 are more than the other discases.
- The highest total patient-days of stay.
- Total patients days per FTE physician are also high.
- Cost /bed is also high which next to HI diseases
Using the step-down technique for the allocation of hospital, the department has the following good efficiency indicator:

- The total number of admissions is the highest at one hospital (23).
- The cost per day is the low in the ICU inpatient department (Rs 5433.06)
- The occupancy rate and turnover rate are high, 20% and 2.3 respectively.
- The number of admissions per physician is the highest in the ICU inpatient departments (7.6).
- Number of the patient-days per physician is 24, which is highest among the diseases.
- The number of FTE physicians per occupied bed is the least in the hospital (0.3) for all the diseases.

The hospital is considered to be one of the most efficient for ICU departments for the RTA diseases due to above good efficiency indicator for diseases.

Personnel cost absorbs 37.89 percent next to this medication 26.87% and supplies 28.86 % of the total cost. The cost per patients is Rs 17,007.83.

3.8.5] Diseases Pertaining to Abdomen (P/A)

General Characteristics of Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>12</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>55.92 + 19.35</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>86</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>60</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>5 + 5</td>
</tr>
<tr>
<td>Average LOS in hospital</td>
<td>7 + 6</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C5 pp. 143)
Cost categories:

Table 24: Cost Components of P/A

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>217200.00</td>
<td>47.78</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>6280.00</td>
<td>1.38</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>10550.00</td>
<td>2.32</td>
</tr>
<tr>
<td>Medication</td>
<td>125955.00</td>
<td>27.71</td>
</tr>
<tr>
<td>Supplies</td>
<td>93900.00</td>
<td>20.66</td>
</tr>
<tr>
<td>Laundry services</td>
<td>45.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>611.00</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>454542.00</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C5 pp. 144-146)

Cost Analysis

- Other Doctor Charges: Rs 1,11,162.
- Total hospitalization cost: Rs 4,54,542 - Rs 1,11,162 = Rs 3,43,380.00
- Total cost for this disease: Rs 3,43,380.00
  (18.43 percent of total Cost of ICU patients)
- Cost per inpatient admission: Rs 28615
- Cost per day: Rs 5723
- Average cost per bed: Rs 34338

Efficiency Indicators

- Total admissions: 12 (11.32 percent of total admissions)
- Number of beds: 10
- Average patient-days or stay: 60 (17.04 percent of total patient-days)
- Occupancy rate: 17%
- Bed occupy in days: 26
- Bed turnover rate: 1.2
- Average length of stay in days: 5
Department Staff

• Number of full time equivalent physicians: 3
• Average admissions per FTE physician: 4
• Average patient-days per FTE physician: 20
• Number of FTE physicians per bed: 0.3
• Number of nurses per FTE physician: 1

The cost per bed, Rs 34338., is the third highest in the hospital. The average cost per admission is Rs 28615., which is the highest cost after the HI and CNS. This high cost per admission is a result of the low admission, 12 patients, representing 11.39% of total admissions.

The cost per day is Rs 5723. Again, this number represents the highest cost as compare to the other diseases.

Personnel, medications and supplies absorb the highest cost in the total cost and their percentage of absorptions are 47.78, 27.21 and 20.66 respectively.

The ALOS is within range of the average at 7±6 days (5 days). However, because of the high occupancy and turnover rates at 17 and 1.2 respectively;

The total number of personnel working within the ICU department is only 0.3 per bed, which is the same for all. The number of patients per FTE Physicians is 4, which is the lowest as compared to other.

From the above analysis it is observed the hospitals are less efficient as compared to other diseases.

3.8.6) Head Injury (HI)

General Characteristics of Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Patients</td>
<td>21</td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>43.5±24.2</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>144</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>70</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>3 ± 4</td>
</tr>
<tr>
<td>Average LOS in Hospital</td>
<td>7 ± 8</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C 6 pp.147)
Cost categories:

Table 26: Cost Components of HI

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>296650.00</td>
<td>59.26</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>7980.00</td>
<td>1.59</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>10550.00</td>
<td>2.11</td>
</tr>
<tr>
<td>Medication</td>
<td>108856.00</td>
<td>21.75</td>
</tr>
<tr>
<td>Supplies</td>
<td>75400.00</td>
<td>15.06</td>
</tr>
<tr>
<td>Laundry services</td>
<td>79.00</td>
<td>0.02</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>1070.00</td>
<td>0.21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>500585.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C6 pp. 148-150)

Cost Analysis

- Other Doctor Charges: Rs 84,405.00
- Total hospitalization cost: Rs 5,00,585 - Rs 84,405.00 = Rs 4,16,180.00
- Total cost for this disease; Rs 4,16,180.00
  (22.34 percent of total cost of ICU patients)
- Cost per inpatient admission: Rs 19818.
- Cost per day: Rs. 5945.42
- Average cost per bed: Rs 41618

Efficiency Indicators

- Total admissions: 21 (19.81 percent of total admissions)
- Number of beds: 10
- Average patient-days of stay: 70 (17.04 percent of total patient-days)
- Occupancy rate: 20%
- Bed occupy in days: 30
- Bed turnover rate: 2.1
- Average length of stay in days: 3.3
Department Staff

- Number of full time equivalent physicians: 3
- Average admissions per FTE physician: 7
- Average patient-days per FTE physician: 23.33
- Number of FTE physicians per bed: 0.3
- Number of nurses per FTE physician: 1

For this disease, the highest total cost of Rs 416180 in spite of the high admissions of 21 patients, which is the second highest admission after RTA at 23 patients. The cost is high at Rs 41618 per bed. This high cost per bed is a result of the low average length of stay at 3.3 days, resulting from the relatively low total days of stay.

21 patients occupy the bed 30 days out of 151 days of study period, which is the second highest occupancy of bed after RTA at 31 days.

The high total cost for this disease is a result of:

- High number of admission per FTE physician. 23.33, which is the second highest average patient-days per FTE physician after the RTA. Using the stepdown method, the number of personnel serving for this disease is equal to about 7 patients per FTE personnel.

- Personnel cost absorb 59.26% of total cost, which is the highest in the hospital.

- The occupancy rate, 20%, is also high among the diseases.

- The turnover rate is also high which is 2.1.

The ICU department has 10 beds. The number of total patient days stay, and admissions per physician is relatively high at 70 and 7 respectively.
3.8.7] Other

General Characteristics of Patients

Table 27: Characteristics of 'Other' Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Absolute No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>11</td>
</tr>
<tr>
<td>Male</td>
<td>8</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
</tr>
<tr>
<td>Age (in years)</td>
<td>48.19.7</td>
</tr>
<tr>
<td>Total inpatient days</td>
<td>51</td>
</tr>
<tr>
<td>Total inpatient days in ICU</td>
<td>29</td>
</tr>
<tr>
<td>Average LOS in ICU</td>
<td>3.2</td>
</tr>
<tr>
<td>Average LOS in hospital</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C7 pp. 151)

Cost categories:

Table 28: Cost Components of Other

<table>
<thead>
<tr>
<th>Cost Components</th>
<th>Cost in Rs</th>
<th>In %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td>88420.00</td>
<td>57.17</td>
</tr>
<tr>
<td>Diagnostic tests</td>
<td>4360.00</td>
<td>2.82</td>
</tr>
<tr>
<td>Laboratory test</td>
<td>2550.00</td>
<td>1.65</td>
</tr>
<tr>
<td>Medication</td>
<td>33583.00</td>
<td>21.71</td>
</tr>
<tr>
<td>Supplies</td>
<td>25150.00</td>
<td>16.26</td>
</tr>
<tr>
<td>Laundry services</td>
<td>42.00</td>
<td>0.03</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>560.00</td>
<td>0.36</td>
</tr>
<tr>
<td>Total</td>
<td>154665.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: (Appendix C, Table C7 pp. 152-154)

Cost Analysis
- Other Doctor Charges: Rs 29,155.00
- Total hospitalization cost: Rs 1,566.00 - Rs 29,155.00 = Rs 1,25,510.00
- Total cost for the disease: Rs 1,25,510.00
(6.3 percent of total cost of ICU patients)
• Cost per inpatient admission: Rs 11410
• Cost per day: Rs. 4227.93
• Average cost per bed: Rs 12551

**Efficiency Indicators**
• Total admissions: 11 (10.37 percent of total admissions)
• Number of beds: 10
• Average patient-days of stay: 29 (1.81 percent of total patient-days)
• Occupancy rate: 8 %
• Bed occupy in days: 12
• Bed turnover rate: 1.1
• Average length of stay in days: 2.63

**Department Staff**
• Number of full time equivalent physicians: 3
• Average admissions per FTE physician: 3.6
• Average patient-days per FTE physician: 9.6
• Number of FTE physicians per bed: 0.3
• Number of nurses per FTE physician: 1

The Group of diseases 'Other' have the lowest total cost or Rs 125510 (6.3 percent of total cost of ICU). Occupancy rate is quite low at 8 percent, which is the lowest occupancy rate as compared with other diseases.

The average cost per bed for this disease is Rs 12551. The average cost per admission is Rs 11410. Medication and Personnel costs in this disease constitute an average of 22 percent and 57 percent of total cost.

**3.9 Discussion and conclusions**

The present cost analysis study the diseases group of patients admitted to ICU is undertaken to determine patients and hospitals resources consumptions at a microeconomic level. The selection of the ICU based on the fact that belongs to one of the popular super specialty hospitals in Amravati region. The diseases are chosen based on the fact that majority of the patients were found during the study period. The importance of carrying out
such study, broad estimation of hospitalization cost for a specific disease in view of the fact that similar economic evaluation studies, diagnostic or clinical performance criteria [2].

A more detailed investigation of patient's personnel clinical and economic records had led to estimation of total hospitalization cost for specific disease or patients group.

The use of economic analysis techniques could substantially contribute initially at a micro-economic level to the costing diseases across the country and thus to the introduction of most current perspective hospital financing system as these are encountered on an international level.

It must be mentioned that there are some methodological limitations, concerning the data used that have to be identified. Hospitalization cost estimate are given on the basis of the information collected through the administrative and the hospital bill of the patients. Our choice is based on the basic parameters like majority of patients, hospital charges and the last one was to obtain the information about the cost of diseases (direct, indirect, inpatient or out patients).

The development of a hospital information systems helps to hospital outcomes and related cost. The cost is easily separate out diseases wise and analyzed. Also the economic assessment findings help in decision-making.

A performance-based incentive system that incorporates efficiency indicators as those assessed in this cost analysis, plus additional indicators of quality of care, patient satisfaction, and rewards for the hospitals and managers that achieve outstanding gains is one feasible method for improving management. This cost study does not address how quality of care and efficiency interact.

Quality of care depends upon technically skilled staff, effective operation of equipment used for diagnosis and treatment, adequate drugs, medical supplies, and proper sanitary conditions. This hospital is deficient in several areas and should be improve in efficiency and quality. Improved quality of care is likely to increase patient utilization, while improving the operating efficiency of the hospital.

The average length of stay (ALOS) is an important indicator of the efficiency of hospital resource utilization. Differences in the average length of stay among
comparable types of diseases imply differences in prevailing treatment practices across the hospital.

A high bed occupancy rate does not always indicate better hospital performance. If the bed occupancy rates are too high, meaning is that the volume of services provided to the patients is maximum. The implications of high occupancy rates may reflect relatively efficient situations, as when many patients with modest lengths of stay are served (that is high bed turnover rate).

Long lengths of stay tend to have lower than average costs per day because the treatment costs for the additional days less than the first day i.e. it falls below the average. However, low bed costs are not necessarily a true indicator of inefficiency. This is because lower bed costs can be the result of higher occupancy without increase inefficiency.

In this chapter we have focuses on the cost analysis and the allocative efficiency of the hospital for a particular diseases. The study related to the technical efficiency and the cost effective techniques are presented in the chapter number 4.

The calculated and measured values occurs in the throughout discussion are presented in the respective tables and in the particular diseases head in Appendix C. (pp.129)

**The main outcomes from this study are**

- The economic evaluation on the microeconomic level helps the physician to monitor the hospital functioning system and cost related to various factors.
- Cost analysis helps the physician for the development of the hospital
- Economic assessment finding helps to the decision making
- Allocative efficiency indicators are defined for improving the management in the sense that providing the best quality of care and patients satisfaction
Figure 4: Distribution of Cost Component

Figure 5: Distribution of Total Cost for Various Diseases.
Figure 6: Important Indicator for Allocative Efficiency

Figure 7: Occupancy Rate Vs Turnover Rate