



## To Study the System of Maintenance of Hospital Support Service Equipment and Their Utilization in A Public Sector Super Tertiary Care Hospital

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### ABSTRACT

**Introduction:** Medical equipment in the hospitals is characterized by large range and variety, high rate of induction as well as obsolescence due to rapid advancement in medical sciences and technology. Objectives of study was to Study the system of maintenance, utilization of equipment of various hospital support service equipment and Verify gaps if any and develop a model maintenance program for optimum utilization of equipment. **Methodology:** Based on the specific objectives, a study was planned to assess the overall equipment maintenance programme as Retrospective study & Prospective study. **Results:** Overall functional status of select equipment of support service area is 87.26 %. Overall downtime index 17.14 % & Breakdown time maintenance index was 11.14 %. **Recommendations:** It is proposed that all equipment should have Comprehensive maintenance contract for proper utilisation and minimal downtime, Hospital Equipment Utilisation Committee & Equipment Maintenance Model for hospital should developed. **Conclusion:** Efficient equipment utilisation should be ensured to optimise health care facilities.

### KEYWORDS

Equipment maintenance, Functional status, Downtime index, breakdown, Equipment maintenance model

### Introduction

Medical equipment in the hospitals is characterized by large range and variety, high rate of induction as well as obsolescence due to rapid advancement in medical sciences and technology.

Every hospitals holds a large number of equipment in support service area, which are used as frequently as possible and expected to function at their peak efficiency at all times. So long as the equipment functions, it poses no problem, but when it needed desperately to bring it back to the function, more so in the case of vital, scare, high cost and electromedical equipment<sup>1</sup>. Maintenance is a combination of actions carried out to retain an item or restore it to an acceptance condition<sup>2</sup>. It also ensures equipment reliability, productivity, efficiency and safety. Preventive maintenance procedure assures availability of equipment without interruption<sup>3</sup>.

### An optimum utilization of equipment will result in:

- Optimal patient handling and rapid turnover
- Minimum possible cost
- Quality patient care and satisfaction to both patient and healthcare provider.

Efficient equipment utilization should be ensured to optimize healthcare facilities. Support services in hospital include Laboratory, Radiology, Blood Bank Dietary, Laundry, CSSD, Pharmacy, and Manifold etc.

### Hence the study was undertaken with the following objectives:

- To Study the system of maintenance of various hospital support service equipment.
- To Study the utilization of equipment in various support service area in a Public Sector Super Tertiary care Hospital.
- Verify gaps if any and develop a model maintenance program for optimum utilization of equipment

### MATERIAL & METHODS

Based on the specific objectives, a study was planned to assess the overall equipment maintenance programme of support services in a Public Sector Super Tertiary care Hospital.

### PLAN OF STUDY

The study was planned in two parts:

- Retrospective
- Prospective

**Retrospective study** was done by studying the documents and records pertaining to repair, maintenance and utilization of equipment.

**Prospective study** was done by on the spot observation and interviews with key personnel of the respective areas of study.

**Study setting:** Public Sector Super Tertiary care Hospital New Delhi.

**Study Design:** Cross-sectional, Descriptive

**Study Population:** Select support service equipment

### Inclusion

Equipment procured for support services including Radiology, Lab Medicine, Blood Bank, CSSD, Laundry, Dietary and Manifold, during the period of 01st April 2005 to 31st March 2008. All the equipment taken in study is in midlife of 5-8 yrs in which wear and tear started.

**Exclusion:** Outsourced equipment / facility.

### PHASES OF THE STUDY:

The study was carried out in following phases:

**Phase I:** Discussions with key personnel concerned & visit of dept.

**Phase II:** The various letters, memos and requests for maintenance of equipment from various clinical departments were also studied.

**Phase III:** Functional status was assessed and utilization coefficient of the select equipment calculated.

**Phase IV:** Data was tabulated in excel 2007, inferences were drawn

### Assessment of Functional status of Equipment

Two cross sectional studies were undertaken with a gap of three mths and the functionality were tabulated.

**Table 1:Functional status of Equipment**

Sr.no	Equipment Name	Date of 1 <sup>st</sup> inspection F / NF	Date of 2 <sup>nd</sup> inspection F/NF	% Functional	% Non-Function

**Assessment of Utilization index of Equipment****Table 2:Utilization Index status of the Equipment**

Sr. No	Equipment Name	N = Average number of hours the equipment is actually used per day	M = Maximum number of hours the equipment can be used per day	Use Coefficient (U.C)
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Where N = Average number of hours the equipment is actually used per day. M = Maximum number of hours the equipment can be used per day.

**Table 3:Downtime Index & Breakdown Maintenance Index**

Sr.No.	Equipment Name	Downtime Index Downtime per week x100 Available machine hour per week	Breakdown Maintenance Index Labour hour spent on breakdown maintenance x 100 Labour hour spent on all maintenance (preventive + breakdown maintenance time in hrs)
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- Available machine hours = [(weekly working days ) x (hours per day) x ( number of machine )].
- Downtime per week: Total downtime in a year / number of week in one year
- Each time labour hr spent on repair = ..... hrs( mechanic spent on repair)
- Preventative maintenance: ..... hrs each day ( spent each day )
- Weekly working days: ..... days ( total number of working days)
- Hours per day: ..... hrs ( machine runs )
- Number of machine: calculated for single machine.

**OBSERVATION AND DISCUSSION****GENERAL SURVEY OF EQUIPMENT IN SUPPORT SERVICE DEPARTMENTS AND HOSPITAL:**

All support service departments of hospital were visited to survey the various types of support service equipment available ; their purchase procedure, source of funding, maintenance systems practiced ; functional status of equipment etc. discussion were held with key personals concerned with running and maintenance of the equipment such as Engineer, Finance officials, Store officer, Technical officer, Technicians, Doctors, Head of the departments to have an overall idea of the equipment management system including maintenance.

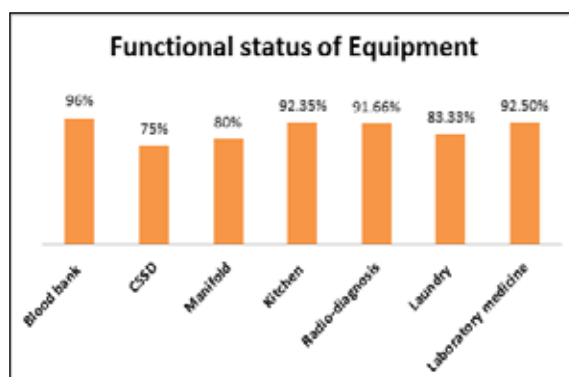
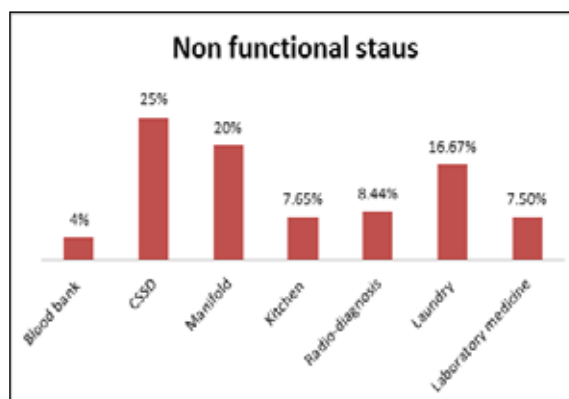
The institute workshop carries out only breakdown maintenance. The preventative maintenance of sophisticated equipment were either carried out by the contractors or by the users. At some places like indoor areas, preventative maintenance was not carried out for routinely used equipment. Users have mixed reaction on their satisfaction for on-going maintenance programme. Users have mix reaction on their satisfaction for on-going maintenance program. A large number of users do not know the cost of equipment and its maintenance. Other key issues involved in the equipment management such as schedule of maintenance, availability of spare parts, availability of maintenance services in time and response time of the equipment, training programme for the users, log book maintenance, availability of operating manual, payment to the contractor and in-house biomedical services etc. were also discussed with the person concerned.

**Problem faced by workshop**

1. Paucity of manpower
2. Insufficient budget allocation
3. Non availability of spares of many makes of same equipment.
4. Condemnation of some of the equipments is not possible as technical specifications are not available.
5. Manhandling of equipments by user leading to equipment in unserviceable state.

**Bottle neck:**

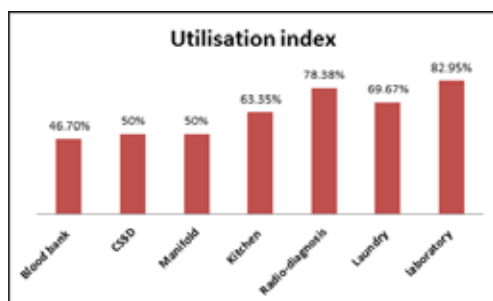
1. Different makes of same equipment.
2. Log books are not maintained.
3. Service manual or catalogue is not available ..
4. Manhandling of equipment by the user.
5. Lack of day to day maintenance practice .
6. Inferior quality vendor identification by the purchaser.

**Final observation of select support service area of hospital :****Figure 1: Functional Status of support service equipment****Figure2: Non Functional Status of support service equipment****Observation of functional status of select support service equipment :**

Overall functional status of select equipment of support service area was 87.26 % and non-functional status is 12.74 %.

**Reason of non- functional status of select support service equipment as given by key informants:**

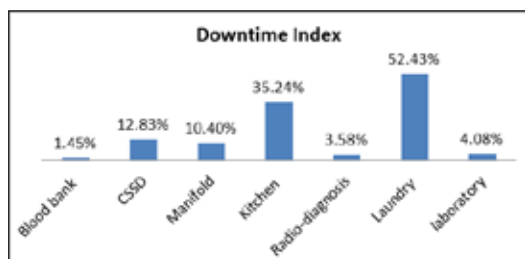
1. Spare part not available.
2. Delay in financial sanction
3. Support from engineering services not adequate.

**Figure 3: Utilization Status of support service equipment****Observation of utilisation index of select support service equipment :**

Overall utilisation index status of select equipment of support service area was 63 %.

**Reason of low utilisation index of select support service equipment :**

1. backup equipment which is used less.
2. Some equipment were critical but their utilisation is very less. ( e.g. centrifuge machine etc).

**Figure 4 : Downtime index status of support service equipment****Observation of Downtime index of select support service equipment :**

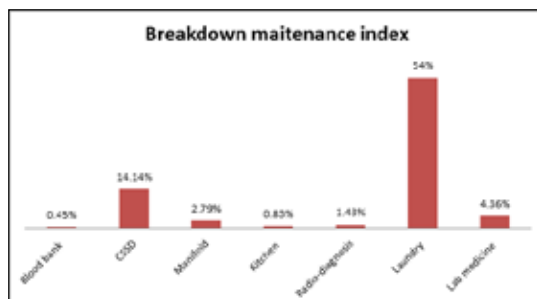
Overall downtime index status of select equipment of support service area was 17.14 %.

**Reason of high downtime index of select support service equipment :**

1. non- availability of spare part.
2. Use of backup equipment rather focusing on repair.

**Observation of Breakdown time maintenance index of select support service equipment :**

Overall Breakdown time maintenance index status of select equipment of support service area was 11.14 %

**Figure 5 : Breakdown Maintenance Status of support service equipment****Reason of high breakdown maintenance index of select support service equipment :**

1. Non- availability of spare part.
2. Use of backup equipment rather focusing on repair.
3. SOPs, Checklist for maintenance were not available in any of the department.

**Recommendations:**

It is proposed that all equipment should have Comprehensive maintenance contract for proper utilisation and minimal downtime. Terms and conditions for the same should be embedded in tender document for the equipment.

It was proposed to constitute a '**Hospital Equipment Utilisation Committee**' to assess the utilisation of equipment of different department.

The engineering services should provide a proactive support to the user department. They should be part of decision making process from beginning, so that they are aware their role in maintenance.

Model Maintenance Program<sup>4</sup> for hospital should be developed as below:

**This must include:**

- Evaluation and selection of Equipment
- Tendering and purchasing
- Training of equipment users
- Provision of appropriate infrastructure and services
- Proper storage and disposition of equipment, including equipment libraries
- Appropriate prescribing of equipment to patients and End Users
- Repair and maintenance
- Safe and legal disposal

**CONCLUSION**

Efficient equipment utilisation should be ensured to optimise health care facilities. A substantial number of equipment in Indian healthcare institutions are of foreign origin. It is imperative that appropriate steps are taken in the planning, procurement, installation, usage stages of these equipment to maximise utilisation and optimise health care facilities<sup>6</sup>.

Equipment Maintenance Model for hospital has been developed to ensure that medical equipment is acquired, stored, deployed, maintained and decommissioned in such a way that the risks inherent in its use are minimised and that its ownership represents good value for the hospital<sup>7</sup>.

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