

Maintenance and repair of major equipment in a district hospital

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Abstract

This descriptive-cum exploratory study was undertaken in the district hospital, Gurgaon in the State of Haryana to find out the status of maintenance and repair services for the major equipment in all areas of the hospital. The study was conducted by interviewing the concerned personnel using a structured questionnaire and by filling up a structured proforma for each item of major equipment. There was no system of regular maintenance either planned/scheduled or preventive. Only breakdown maintenance was found prevailing which was also neither proper nor convenient. The breakdown or out of order equipment was 36.5% of the total available equipment out of which only 20% was repairable and the rest 80% had become unserviceable lying for want of repairs for years. Based on the findings of the study and the discussions with concerned personnel and experts, suitable recommendations have been formulated.

Key Words: Medical Equipment, Maintenance, Repair, District Hospital.

Introduction

Maintenance may be defined as any action or combination of actions, carried out to retain in or to restore equipment to an acceptable working condition. Its main objectives are to keep the equipment in acceptable working condition to assure its optimum availability for use, to prolong its useful life and thus to assure maximum possible returns on the investment made while at the same time ensuring the safety of the patients as well as the operators. Newbrough (1) has classified the maintenance work of an organization into 5 types namely preventive maintenance, repair, overhauls, major modifications and manufacturing. Preventive maintenance covers inspection, adjustment, oiling and greasing, replacement of worn out parts and minor repair of parts or components indicated during inspection. Repairs include the emergency repairs and replacement of parts which are not the result of preventive maintenance. Overhaul is complete dismantling and renovation of the equipment. Major Modifications are the additions to the existing

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equipment either to improve its performance or for safety. Manufacturing involves construction of parts of the equipment needed for repair, renovation or maintenance.

However, Krishna (2) has divided maintenance into two main systems viz. Breakdown Maintenance and Preventive Maintenance. In the case of former usually referred to as repair, the equipment is generally attended to when it is no longer able to function and there is a breakdown. The necessary repairs are then carried out to restore it to working order. This system has many disadvantages e.g. disruption of work schedule and the unpredictability of downtime as the availability of needed spare parts and the nature of repair can not be predicted. However, this system may be more suitable and even cheaper in certain situations such as in case of non-critical equipment when stand-by equipment is available and quick switching over can be done; in case of obsolete equipment where replacement is under consideration; in cases where plant capacity exceeds demand; and at far off places where there is no maintenance staff available and has to be called from distant places. In the case of the second system i.e. preventive maintenance, the condition of the equipment is kept under watch through a systematic inspection programme and preventive action taken to reduce the incidence of breakdown. It has been defined as “the performance of a repair or component replacement prior to equipment failure, with the action scheduled for an off shift, if possible and even in specific seasons so that there is least disruption of work schedule. According to Mc Gibony (3), this system is better due to its obvious advantages. The operational costs are also optimal.

Hence, we may say that the maintenance whether routine day-to-day or planned/scheduled preventive maintenance of the equipment when it is in working condition and prompt repair in case of its breakdown, is of utmost importance for the efficient and effective utilization of equipment in any organization more so in a hospital where it is estimated that the initial cost of installed mechanical and electrical equipment may exceed 40 percent of the total cost of the building and also in view of the criticality cost as human lives are involved. With rapid advances in science and technology as also in the field of medical sciences, the hospital equipment are day by day becoming more and more sophisticated and specialized as well as more complex and expensive. Consequently the importance and need for efficient maintenance and repair of biomedical equipment has increased manifold due to the massive influx of high technology and huge investments in this field after the World War II and particularly during the last few decades.

This study was conducted in a district hospital of Haryana State to find out the status of existing maintenance and repair procedures of the major equipment and to suggest an efficient and effective maintenance and repair service for a 100 to 200 bedded General Hospital at the district headquarters.

Methodology

The study was of descriptive-cum-exploratory in nature and covered major equipment of Group I and Group II (excluding furniture, both wooden as well metallic and fixtures) as per broad classification of Gregor and Mickey (4). The general information regarding the existing procedures for maintenance and repair of the equipment was obtained from the concerned officer in charges, doctors, technicians, repair and maintenance staff, etc., by interviewing them with a structured

questionnaire having both open and close ended questions. The specific information about each item of the equipment regarding its repairs and maintenance, time and money spent on the same, problems faced and the personnel and facilities available and required for the purpose, etc., as well as the suggestions of the in-charges and concerned technicians for improvement were obtained by interviewing them and filling up another structured schedule also having both open and close ended questions. Personal observation, discussion with academicians, administrators and experts in the field as well as the study of published and unpublished reports of the scholars and various committees on the subject were also taken into consideration while making recommendations in this regard.

OBSERVATIONS AND DISCUSSION

Major equipment in 19 different departments/services/facilities of the hospital was studied and the findings were as under:

1.	Total No. of major equipment available	:	376
2.	No. of Breakdown (Out of order) equipment	:	137
3.	Percentage of Breakdown equipment	:	36.5%
4.	No. of reparable equipment	:	28
5.	Percentage of reparable equipment	:	20%
6.	No. of unserviceable/condemnable equipment	:	109
7.	Percentage of condemnable equipment (Out of 137 breakdown equipment)	:	80%

There was no system of regular maintenance or check-up of the equipment in the hospital and no such procedure was carried out routinely except the cleaning and dusting of the working equipment. Only the system of Breakdown Maintenance was found prevailing. The system of Preventive Maintenance as highlighted by Mehta (5) as far back as 1974 and by Sakharkar (6) in 1979 was not found existing in the hospital. The repairs were carried out mainly either from the manufacturers/authorized agents or from local/Delhi firms. Lately the Electronics Research, Development and Facilities Centre (E.R.D.C.) Gurgaon, an approved source, was also inducted in the repair work. The concept of Hospital Workshop as recommended by Rao Committee (7), Verma Committee (8) as well as by the World Health Organisation (9) and various other studies was also not found existing there. Only one trained electrician was available in the hospital to rectify minor electric faults and problems. However, one exception was observed in the case of the equipment under the Universal Immunization Programme (U.I.P.) in the Post-Partum Centre (P.P.C.) for which a Refrigeration Mechanic was available in the U.I.P. for its maintenance but he was working under the administrative control of the District Immunization Officer (D.I.O.). There was also no system of Annual Maintenance or Service Contracts for any of the equipment.

The breakdown repair in some cases was very costly and delayed as was observed in the Central Sterile Supply Department (C.S.S.D.). Three repair bills of the only one functioning Autoclave

during the first six months of the year were found to be more than 60% of its purchase cost. Another breakdown Autoclave in the same department could not be repaired for more than 12 years as the manufacturer had stopped its production and repair.

In the absence of an established system of repairs and maintenance, such a large number of equipment were lying in breakdown condition for so long periods that over the years, many of those had become unserviceable and condemnable. It was observed that out of a total number of 376 equipment available in the hospital, more than one fourth i.e. 109 in number (29%) were lying for condemnation. There was also a tendency to keep the equipment as reserve/spare as there was no proper and convenient system of repair, so that in case of breakdown of equipment, the reserve one could be used. The tendency to carry on the work with some alternative equipment kept as reserve or by outside referrals also deterred the administrators from the urgency of repair. This in the absence of a regular system of condemnation and disposal had resulted in a vicious cycle leading to the piling up of unserviceable equipment compounding the shortages of the equipment in the hospital.

Regarding the records pertaining to the repair and maintenance of equipment, the study revealed that no proper breakdown/repair/maintenance registers or records were maintained for any of the equipments and only in some departments, the record of the repair bills verified by them was kept. In most of the cases, instruction manuals and circuit diagrams of the equipment were not available (available for only 21 items). Even the records of the cost of purchase and particulars of the supplier, etc., were rarely available in most of the departments. There were no proformae available for recording/reporting of breakdown/status of the equipment except one in Dental department for reporting to the State Directorate. There was no system of maintaining any "Log Book" or "Life History Card" for any of the equipment. Further no instructions about keeping or storing of the equipment after use or when not in use, were available with any of the operators nor were they much aware or conscious of this important aspect in most of the cases.

During the discussions, the administrators and the experts in the field, they pointed out that full-fledged workshops at the level of the district hospitals will not be economical as the workload will not be sufficient and the returns will not be commensurate with the investment involved. In this connection, the example of the Transport section of Haryana Health Department was also highlighted whose maintenance workshops were incurring heavy losses. However, the need for a small workshop with skeletal services at the level of the district hospital and more specialized services at the State level was suggested by them. The importance of Annual Maintenance/service Contracts for the sophisticated equipment was also realized by them and the preference should go to the manufacturers or the approved sources like E.R.D.C., Gurgaon, an enterprise of the Haryana State Government.

Recommendations

The recommendations of this study are based primarily on the interviews and discussions held with the managerial and other supportive staff of the hospital (39 in number) as well as the actual on the spot observations of the departments/facilities. The opinion of the experts in the respective

fields, as also the recommendations made by various committees set up by the Govt. of India, as well as the studies of other researchers in this field were also given due consideration. However while formulating the recommendations, due attention has also been given to the fact that the suggestions should be feasible to implement with least possible financial burden.

1. Standard Lists and Specifications: There should be standard lists of equipment as per recommended norms for each level /size of hospital and standard specifications for each equipment so that there is uniformity as far as possible. It will facilitate maintenance, procurement of spares and repairs.

2. Initiation for Purchase and Pre-requisites: The purchase of any equipment must be initiated only by the user and the requisition should be on a prescribed standard proforma having details about its real need and justification, specifications and accessories/spares required, availability/need for physical infrastructure/facilities/consumables and trained staff for its operation and maintenance as also availability of repairs and spares. If these pre-requisites are not met, any equipment should not be purchased even from the standard approved list and should not be accepted even as a free gift or donation.

3. Direct Purchase from the Manufacturers: As far as possible, the equipment should be purchased directly from the manufacturers or at least through their authorized dealers only, to ensure both economy in the total cost as well as better after-sale services.

4. Installation and Commissioning: The installation and commissioning of the equipment at the user's site by the manufacturer/supplier either free of cost or with an appropriate provision, should be an essential condition of the purchase contract. Full payment should only be made after the satisfactory report by the operators/users regarding its installation and being made fully operational.

5. Warranty: It must be ensured that the purchase contract contains a genuine warranty clause, as per standard practice for each equipment, for any manufacturing defects and it must be insisted for at least two years. Further, this clause must be used promptly as and when the situation warrants.

6. Instruction Manuals and Circuit Diagrams: In case of sophisticated electric and electronic equipment, the suppliers must furnish the instruction manual/brochure and circuit diagram along with the equipment or even before that.

7. Maintenance during Warranty Period: It must be ensured that the maintenance of the equipment during the warranty period would be the responsibility of the manufacturer/supplier, who shall provide adequate preventive maintenance and also prompt breakdown services as and when needed. The technicians/operators of the equipment must be trained during this period, preferably by the manufacturer, for its maintenance and minor repairs.

8. Service Contract: All sophisticated equipment must be put on Annual Maintenance/service contract with the manufacturers/authorized service agents after the expiry of the warranty period.

It should specify regular periodic preventive maintenance and prompt repair including the cost of spares with a penalty clause for delay beyond the specified down-time.

9. Role of the User/Operator: The main thrust of the maintenance system should be on the user/operator of the equipment, who should be properly trained and made responsible for its maintenance. The recommendations in this regard are as follows:

- i. The operator should undertake preventive maintenance and rectify minor faults.
- ii. There should be a written check-list for regular inspection of each equipment and clear written instructions should be there for keeping/storing the equipment after use or when not in use.
- iii. A copy of the Instruction Manual and Circuit Diagram of the equipment must be supplied to its user/operator.
- iv. Prompt reporting of breakdown should be undertaken on the proforma which need to be developed and made available to all the operators.
- v. A "Life History Card" for each major equipment containing all relevant details right from the time of its supply till it is disposed off, should be maintained in the store of each department.
- vi. A "Log Book" for each equipment mentioning its utilization, maintenance, breakdown and repair, should be maintained and kept available for verification.

10. Hospital Workshop: A small workshop should be established in each hospital at district level to look after the maintenance and minor repairs of equipment including furniture, with a skeletal staff of about five to six viz Electrician or Electrician-cum-rewinder, Carpenter-cum-Painter or Carpenter-cum-Welder, Instrument Mechanic-cum-Fitter and Plumber. Some of these already exist in hospitals and rest can be added. All these posts should be filled with personnel trained at Industrial Training Institute (I.T.I.). The workshop should be equipped with necessary tools and spare parts. The workshop of the district hospital can also help the peripheral units (C.H.Cs & P.H.Cs) in the maintenance and repair of equipment.

11. Budget: Separate budget should be allocated for the maintenance and repair of equipment.

12. Decentralization and Delegation: There should be delegation of powers to the Civil Surgeons, Medical Superintendents and further to the Heads/Incharges of various services to avoid delay in routine maintenance and repair of equipment.

13. Regular Reporting of the Status of Equipment: Every District & even sub-district hospital must send a regular report to the District and State Health Administration, along with other monthly reports, about the status of major equipment in the hospital with a mandatory certificate to the effect that "all equipment is in working order and those needing repairs had been sent to a workshop or a technician has been called to repair it. All the equipment declared unserviceable or beyond economic repairs or obsolete, has been sent for condemnation and not lying in the hospital."

14. Condemnation: Last but not the least, all equipment declared obsolete or unserviceable/ irreparable or beyond economic repairs by the competent technical persons, should be pooled together and disposed of at frequent intervals to prevent unnecessary piling of non-functional equipment.

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