



Departmental equipment maintenance system in Government Medical College

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Abstract

Background: Medical equipments are necessary to effectively monitor, treat and support the care of patients by doctors in the management of their medical conditions. Proper maintenance affects the performance and safety of equipment. As equipments are part of health care provision in hospital, it is necessary to have well planned and managed equipment maintenance system in the organization.

Aim: The study revealed the medical equipment maintenance system in Physiology Department of tertiary care government teaching institute.

Material and methods: A retrospective observational study, during February to June 2014 of fifty-two equipments costing more than 10,000 rupees was done for their maintenance system in the department. Information about equipment was collected by onsite inspection and departmental equipment records in structured proforma.

Results: In the study, 45 mechanical and 7 electrical equipments costing less than 100,000 rupees were evaluated. It was found that 94.2% equipments did not have any service contract. From time of installation in the department it was found that most equipment i.e. 53.8% had crossed the life period of 15 years. Maximum i.e. 85.7% electrical equipments had crossed their average life period. There was no proper maintenance of logbook and non availability of the user manual by the side of 84.6% of the equipments in department. Service history in worksheet of all 52 instruments was not recorded, post warranty maintenance in all equipments was by local personals only which was needed in 90.4% equipments. Out of equipments needing the maintenance and repair, it was



corrective type in 98.2% times and reactive type in 1.8% times. There was no special training of the technicians about the maintenance of equipments. 73.1% equipments were working while 21.2% were awaiting repair. The procedure of 'maintenance request' was noted in log book for all equipments. 3 of the equipment were having the long down time period above 5 years. Non functional equipment with long down time period was due to non availability of the spare parts in 21.2% equipment and vendor was not responding for maintenance in 5.7% equipment.

Conclusion: There was need of proper equipment maintenance system in department. The long down time period of equipment was due to old technology, non-availability of parts and non-responding vendors.

Key words

Medical equipment, Equipment maintenance, Life period, Down time, Reactive maintenance, Corrective maintenance.

Introduction

Increasing number of medical devices is being used to support patient care by hospital and primary care settings. The availability of such devices assists greatly in the ability of healthcare organizations to effectively monitor, treat and support the care of patients and doctors in the management of their medical conditions. It also allows for the management of care in a community setting and facilitates self care for patients in many instances.

Various professions within the health services have direct contact with medical equipment. It is important that professional dealing with equipment need to attain quality assurance health service.

A very high budget is spent on equipment purchase with the increasing need for proper maintenance. With the large number of sophisticated equipments becoming inseparable part of health care provision in the hospital it is necessary to have a well planned and managed equipment maintenance system in the organization.

Medical equipment is characterized by wide range, variety and high rate of obsolescence.

Increasing dependence of medical professionals on equipment, both for diagnosis and treatment, demands their availability at all times through a comprehensive and responsive engineering support [1].

Proper maintenance affects the performance and safety of equipment. Poorly maintained equipment deteriorates more quickly and is more likely to break down. Unreliable or inaccurate equipment is often worse than no equipment at all [2] and can injure the patients [3].

Equipment management is management and control of equipments from procurement to disposal, controlling equipments in an optimum manner at a minimum cost. A survey reveals that of the total cost of a hospital project, nearly 60% involves hospital equipment. With the advent of newer technologies, medical equipment has come a long way in assisting healthcare professionals in diagnosis and treatment. Hence, the purchase, maintenance and replacement of medical equipment are an essential and integral part of hospital management [4].

All equipment is made up of various parts – moving and non-moving, active and passive. At



any time during the life of the equipment, these parts can fail due to wear and tear (this even applies to software). Thus, it is very important to give regular attention to the equipment through maintenance and repair [5, 6].

All medical equipment has an average lifespan. When this lifespan is crossed, it starts showing symptoms of malfunction, and repeated breakdown indicates need of replacement. The duties of user organizations and service providers under health and safety legislation are to ensure that equipment is adequately maintained. Failure to comply with health and safety law is a criminal offence. It is the responsibility of the user organization to ensure, as far as possible, that equipment continues to operate in accordance with its original specification after repair [7]. One survey showed that for 19 large hospitals the average ratio of equipment repair costs to acquisition cost was 7.4% [8].

Findings of the status of the equipment maintenance system in the department will be indicative of the present practices and hence will help as a background scenario. The findings will direct to needed and necessary changes to be done. Patient's management is nowadays totally dependent on the proper functioning of the instrument. So the findings will help for appropriate and timely patient's management along with the economical health expenditure. As the correct procedures and maintenance practices improve the life of the instrument it also gives the opportunity of the economical health benefit to masses.

This study was planned with the general aim to study the present status of equipment maintenance system in the Department of Physiology. Having specific objective, to study the history of depreciable equipment (>10,000 rupees), maintenance schedule, type of

maintenance, log book maintenance, working condition, work order maintenance, number of maintenance.

Material and methods

Present study was observational study from retrospective records and present conditions of the equipments. Study was conducted during February 2014 to June 2014.

Study area

In pre-clinical department of Physiology in Shri Bhausaheb Hire Government Medical College, Dhule, contributing academic and investigative function. It consists of hematology, mammalian physiology, amphibian physiology, clinical physiology, pulmonary function test, and fitness test laboratory. Department has many equipments as per guideline requirement of medical council of India.

Inclusion criteria

Total 52 equipments with more than INR 10,000 cost in the department of physiology were included in the study.

Study method

Detail information related to the history of equipment (date of installation, type etc.), present working status, maintenance history were collected according to the store records and log- book. A retrospective study of the pattern of breakdowns was done from the available records, supplemented by discussions with the functionaries.

Maintenance for any types of equipment was evaluated by three types of check.

- Visual checks or assessments prior to each use.
- More extensive periodic checks.
- Scheduled service checks that are carried out by authorized people.

Results

In present study, out of 52 equipments, there were 45 mechanical and 7 electrical instruments. Out of 45 Mechanical instruments, 40 were compound monocular microscopes, a Benedicts Roths recording spirometer, expirograph, perimeter, inco spirometer and a wright's peak flow meter. In 7 electric instruments there was a photoelectric calorimeter, ECG machine, extension kymograph, overhead projector, portable electronic spirometer and LCD projector.

It was found that life time of 5.8% equipments was less than 5 years. Maximum equipments had life time above 10 years in department from date of installation. All equipments were costing above 10,000 and less than 100,000 rupees, while only one instrument i.e. 1.9% cost 50001 to 99999 rupees. Out of 52 equipments verified in the study only 5.8% had service contract at time of installation. All 52 equipments had warranty period for 1 year from time of installation. Life time indicated that all of the equipments had crossed the warranty period and none of them had maintenance contract. While 76.9% (40) equipments which were microscopes were having a regular yearly service schedule and 23.1% had no service history up-till now. Total 5.8% i.e. 3 were newly purchased hence no maintenance request was needed for them, 88.4% (46) equipments had proper maintenance requests as per **Table - 1**.

Out of 7 electrical equipments, 14.3% were since 10 to 15 years and 85.7% were more than 15 years in the department. Out of 45 mechanical equipments, 6.7% had been installed within 5 years, 44.4% were from 1 to 15 years and 48.9% were procured more than 15 years before as per **Table - 2**.

Operator manual was available besides only 15.4% equipment and none of the equipment had the worksheet. From the available retrospective information, 52 equipments needed 705 repairs out of which 98.2% were corrective maintenance and 1.8% was the reactive maintenances. There was no preventive and predictive maintenance. It was noted that there was no official safety check after repair of any equipments. None of the equipment had the Logbook maintained. Routine visual inspection was done of all the equipments before utilization. None of the equipment had AMC, CMC. Local maintenance for 90.4% i.e. 47 equipments was needed. At the time of study 73.1% equipments were in working condition, 21.2% were awaiting repairs and maintenance request was given since 6 months as per **Table - 3**. Three equipments were in nonworking condition due to non availability of parts and no response from the vendor for maintenance along with the old technology. Down time period for non functional equipment was 6 months for 11 equipments, 5 years for 2 equipment and 6 years for one of the equipment.

Discussion

Medical institutions must perform the appropriate medical equipment maintenance management, in order to provide safe and effective medical care.

Equipment repeatedly requires attention over the years. Like a patient history file, a service history provides a record of the work done on each individual item over time, and keeps the records all in one place. This provides a reference where the specific problems of a machine or item/area can emerge.

In present study, most of the equipment was more than 15 years old. It is known that the life



of medical equipment is definite and it is necessary to plan for replacement and to create the required budget.

Absence of periodic instrumental safety check records was due to non-availability of the biomedical engineer to certify the safety of the instruments. Also many instruments were used for demonstration purpose hence the need was not put for the said safety check though it was necessary.

In this study, it was found that minor technical corrections were done by the untrained technicians as most of the equipments were mechanical.

Also in this study, it was found that maintenance of the equipment was neither preventive nor predictive hence leading to high maintenance and repair need. Contrary to the specialized care needed the minor elements of the equipments was regularly corrected by the technical staff or the users. As mechanical equipments contributed most of the share maintenance by the specialized personal was limited.

In present study, corrective maintenance contributed 98.2% and reactive 1.2% of the total maintenance and repair status.

Similarly Amrollahi MH had found in his study that procurement, distribution and control of medical equipment were in a desirable condition and only the criterion of maintenance was not favorable [3]. In investigative study of Bird CT and colleagues of the equipment problems, reported that, approximately at least two-thirds of the problems could be corrected by properly trained equipment users thus leaving, at most, one-third of the problems need of specially trained maintenance personnel. They have also noted that the men in position were inadequately trained to handle the maintenance

of new equipment and were able to provide repair cover only by hit and trial [5].

Planning and itemization for the maintenance by preventive maintenance of medical equipment not only increase the due ability of the devices, but also reduce repair costs and increase the effectiveness and efficiency of the equipment [3, 9].

According to Nadabaica DC the lack of a maintenance program or an improper maintenance activity can lead to large-scale disasters, with negative consequences for humans and for environment, while if done it was found to be advantageous [6].

The state of equipment serviced by outside agencies on rate contracts was also not satisfactory because of the general lack of coordination and control on this method of maintenance [10]. The scientific means of calculating the efficiency of medical equipment is by equipment audit [11, 12].

As none of the equipment cost in present study was above 1 lakhs there was no annual or comprehensive maintenance contract with the service provider. The contract stipulate which party is responsible for quality control and maintenance checks to ensure that the equipment is supplied ready to use.

In the present study none of the equipment had the logbook maintained. Similarly a study of report of equipment management noted that the unsatisfactory status on maintenance of log books lead the hospitals to know the status of equipment that are within and outside the period of warranty [1].

The World Health Organization and The Commission on Patient Safety and Quality Assurance stressed the importance of adopting



standards and guidelines as a key element of effective governance [12].

The study revealed that there was no central workshop, nor any trained engineers dealing with the maintenance and repair of the equipment in organization.

It was found that due to centralized maintenance responsibility the maintenance Costs decreased, customers were satisfied, and effectiveness increased thus saving money [13].

Study stated that a comprehensive work order management system helps as a resource and workload management tool by managers responsible for personnel time, total number of hour's technician spent working on equipment, maximum repair cost for one time repair or total cost allowed to spend repairing equipment versus replacement [14].

Sakhar B M in his study had also found there was ignorance of equipment users is proper handlings, operations and user maintenance, lack of monitoring and control on the outside servicing agencies, shortage of funds for maintenance, the need for better standard of keeping equipment inventories and records, and the need for a coordinated equipment management system [10].

Medical devices maintenance bulletin stated that the repair and maintenance of medical equipment has an influence on its safety, quality and performance which is needed so that it continues to meet their criteria [7].

Conclusion

The owner of the equipment has responsibility for its servicing and maintenance while user has a responsibility to carry out a visual check of the equipment prior to each use. The findings in

study concluded that maximum equipments had crossed the life period were mechanical equipments. Maximum instruments had no proper service history; post warranty maintenance was by local personals of reactive and corrective type only. Some equipment was having the long down time period which needed the prompt action and replacement as per need.

Recommendation

It is recommended that effective steps be taken to streamline the maintenance and repairs of costly equipment. The deficiency in technical manpower along with up-gradation in their skills to carry out emergency/ minor repairs is required and to reduce the downtime of costly equipment is necessary. It is recommended that the task of preparing a comprehensive inventory management and records should be taken up by the hospital store section and user departments. Training of equipment handlers in correct handling and operation should be conducted. Proper monitoring and control on the outside servicing agencies is need of a coordinated equipment management system. Need of biomedical engineering department for the institution is required.

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Table - 1: Characteristics of equipment depending on date of installation.

Characteristics of equipments		Frequency	Percent
Life time (duration)	<5 years	3	5.8
	10 to 15 years	21	40.4
	>15 years	28	53.8
Cost (INR)	10001 to 50000	51	98.1
	50001to 99999	1	1.9
Service contract at time of installation	Not Done	49	94.2
	Yes	3	5.8
Warranty period	1 year	52	100
Service schedule	No	12	23.1
	Yearly	40	76.9
Maintenance request	No	3	5.8
	Yes	46	88.4
	Not needed	3	5.8
Total		52	100

Table - 2: Life time of the equipments according to type of equipment.

Equipment type	Life time of equipment (years)		
	<5	10 to 15	>15
Electrical (n=7)	0	1	6
	(0%)	(14.3%)	(85.7%)
Mechanical (n=45)	3	20	22
	(6.7%)	(44.4%)	(48.9%)
Total	3	21	28
	(5.8%)	(40.4%)	(53.8%)

Table - 3: Presence of operator manual and worksheet, type of maintenance and present condition of the equipments.

	Findings	Numbers (%)
Presence of operator manual	Not available	44 (84.6%)
	Yes	8 (15.4%)
Worksheet	No	52 (100%)
Type of maintenance and repair	Reactive	13 (1.8%)
	Corrective	692 (98.2%)
	Preventive	0
	Predictive	0
Condition of instruments	Not working can't repair	3 (5.7%)
	Awaiting repair	11 (21.2%)
	Working	38 (73.1%)