Research paper:-hospital information system in clinical engineering department

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Abstract—Medical equipment management is an important issue for safety and cost in modern hospital operation. In addition, the use of an efficient information system effectively promotes the managing performance. The system is web-based, and it integrated clinical engineering and hospital information system (HIS) components. **Objective -** design a framework for implementation medical equipment management system used for clinical engineering department. **Method –** we prospectively enrolled 100 staff (technical staff, consultant and clinical engineering department staff) during 2 April 2012 to 15 April2012. **Result -** The results showed few examples in the error analysis of medical equipment by the maintenance sub-system. There are lacks of proper communication system between CED dept. and other hospital dept (36%), outdated parts (18%), machine location identification (16%). These problem arises because absence of proper complaint system. The hospital information system can be used to improve work quality, to reduce the maintenance cost, and to promote the safety of medical device used in patients and clinical staffs. **Conclusion -** Through related hospital information application, it efficiently improved the operation management of medical devices immediately and continuously. Through HIS we easily manage medical equipment in different department, different location in hospital. HIS helps CED department to manage complaint system in a proper manner so they quickly done solution for a particular complaint.

Key Words — Medical Equipment, Medical Equipment Management, Hospital Information System, Clinical Engineering Department.

INTRODUCTION

TODAY's medical environment is highly dependent on various types of medical equipment to complete the diagnosis and treatment for patients with care. These medical devices must be kept in good condition to prevent from injuries occurred in patients as well as in users. Moreover, to face the tough competition environment and complex health care system, the hospital should take the appropriate cost controls in response to that situation. The clinical engineering department (CED) in the hospital is responsible for the patient and clinical staff safety in using medical devices. Besides, the cost control in related operational activities of medical devices (such as purchase, contract, repair, and maintenance) is another important job for this department [1]-[3]. For these goals, CED is responsible for purchase assessment, safety installation, warranty assurance, correcting repair, contrast monitoring, preventive maintenance, and identifying discard to provide safe, effective, and economical services and equipment that are necessary for patient care research and community service. To promote the operating performance, it is needed with a systematic managing strategy [4]-[6]. The Medical Equipment Management System (MEMS) is used for data collection and management. It incorporates the equipment inventory, a work order system, the preventive maintenance schedules/procedures, outsourcing contract management and all service history records. Besides, it is also an administrative tool to track equipment, to initiate work orders, to obtain performance indicators, to determine equipment failure trends, to identify training needs, and to produce management reports. This paper presents an information framework to build and to enhance CED on the medical equipment management capabilities. With this method, we will show a framework of MEMS from system network architecture to the relationships between each sub-system model.

A study conduct on HMIS by Mona Khandhar et al. (2008)[7] shows that The Health Management Information System (HMIS) has been envisaged to not only help the administrators to have better monitoring and control of the functioning of hospitals across the state using decision support indicators but also assist the doctors and medical staff to improve health services with readily reference patient data, work flow enabled less-paper process and parameterized

alarms and triggers during patient treatment cycle. According to Nolwazi Mbananga et al. (2002)[8] Nurses explained that this information improved by 60-70%, which suggested evidence of qualitative association between the system and socio-demographic data on patients' record. Like many other studies conducted (such as Heeks, et al. 1999 and Anderson et al. 1964) this study, evaluating HIS did not pinpoint real benefits in terms of overall impact on hospitals. The debate about how information systems contribute to hospitals' (or other organization's) effectiveness and efficiency is ongoing. In hospital settings the nature of the organization makes it more difficult. In hospitals a number of different sections function separately but interdependently. This means that the impact can only be measured by considering a number of successful individual activities carried out in each section, which is then added up in a collective process to form the whole impact on the outcomes measured. Drazen, et, al., (1980) explain that in organizations like hospitals the discrete impact of HIS is most predictable and measurable at the level of the individual. This view supports the results of the study, which was able to assess impact at the level of individual staff members (matrons, superintendent and nurses) reported in the qualitative report later. It is clear on the basis of the data that there is a need to develop a fertile ground before the implementation of HIS. There is also a need for users to develop a framework of understanding about how the systems function. *Aniza Ismail etal(2010)*[10]the information system developed in-house doesn't need a very high cost to develop but demands expertise and more number of technically trained personnel to operate. The purpose of implementing these systems is not to compete with each other but serves to facilitate and improve the quality of patient care. Terhilda Garrido et al. (2004)[9] say that the success of the HIS deployment depends on a number of critical factors. First, the commitment of senior leadership to implement clear targets and expectations is crucial to the success of the business case. Second, timely implementation of the inpatient information system is imperative because the consequent impact of delays on benefits realization is costly. Third, Fourth, internal policies must require physicians and frontline staff to comprehensively and accurately codify all hospital discharges and procedures. Finally, workflows must be redesigned to incorporate and exploit the system's functionality.

In this study we shows requirement of HIS, proper implementation and advantage of hospital information system. Few examples on operational management analysis by the MEMS (such as failure trends, specific device malfunction analysis) will be shown in results. These operating data were derived from the operating results in BL KAPUR Hospital (BLK) in April 2012. BLK is a medical center with 700 beds (386 running), 125 modular ICU (68 running) and owns more than 30,000 pieces of medical equipment. We will discuss how to use the information to improve the operation quality and to control the potential risk in medical equipment.

Objective of study design a framework for - implementation of medical equipment management system/ hospital information system in clinical engineering department.

Method & data collection - Cross-sectional, Descriptive study done at Dr. B.L. KAPUR hospital, New Delhi during 2 April to 15 April 2012 among all technical staff (600), consultant (450) and clinical engineering department (20) in the BLK hospital. Out of 1070 Sample, 100 units of sample will be taken from the study population on the basis of random sampling and on the convince method and the sampling would be done from all the department of the hospital prevalent in the study area. In the sampling 60 sample collect from technical staff (10% of total), 30 samples collect from consultant (8% of total) and 10 sample collect from CED dept. (50% of total). Mainly sample taken from technical staff and CED dept. staff because they all are directly related with the use and maintenance of medical equipment. Primary Data will be collected by interview regarding use of medical equipment i.e. daily machine work load, inspection and preventive maintenance schedule of equipment, problem with maintenance of equipment, Mode of complaints in CED department, data lost during compliant, there opinion regarding HIS is useful in hospital equipment maintenance and there training requirements before implementation HIS in CED department.

RESULT

In the maintenance data, we not only look into a general cause of the malfunction but also analyze the causes by specific types of equipment or user behavior.

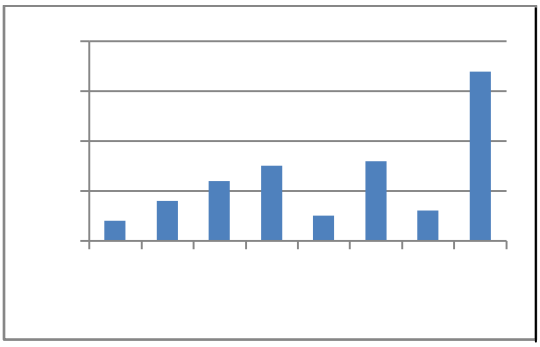


Fig. 3. The statistic graph for the failure items of medical equipment repair cases come from BL KAPOOR Hospital in 2012

Fig. 3 shows the eight types of error code and the statistic graph for the failure items of medical equipment repair cases. The statistic data was explored from the MEMS in BLK Hospital around 100 pieces. Among them the number 8 (data lost or lack of proper communication b/w departments) has the biggest amount. It means that it had a lot of problems most commonly are due to the data lost during complaints of equipment, lack of proper communication b/w CED department and other hospital department during complain for repair of equipment. Moreover, the specific types of equipment failure analysis can be explored from repair records.

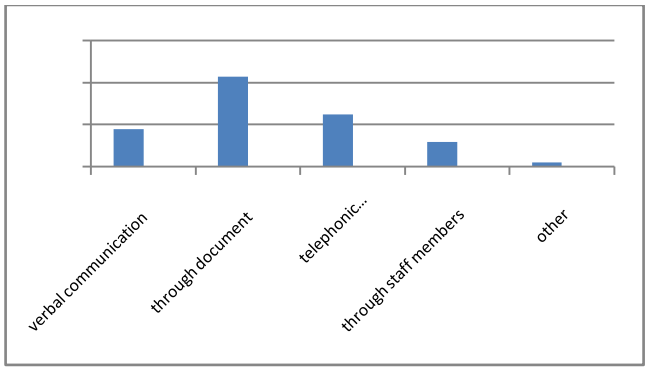
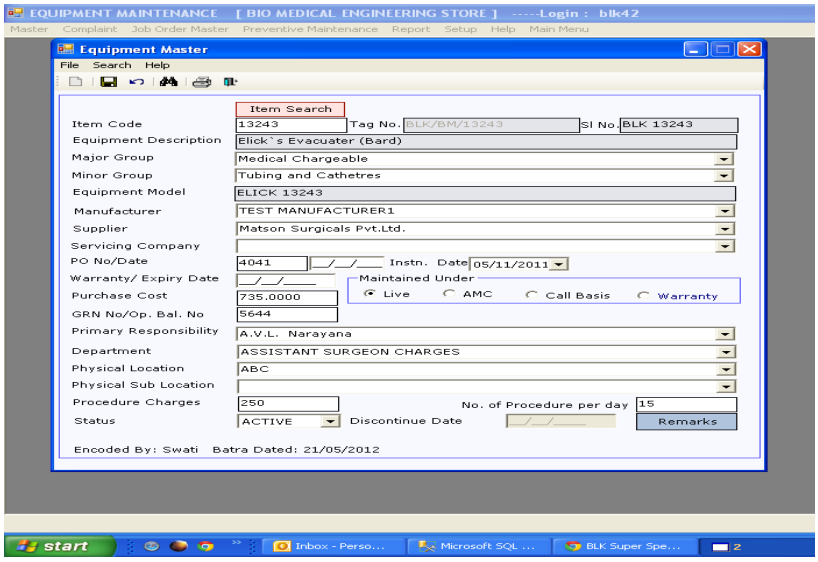


Fig 4:- mode of complaint for repair or damage of equipment

Fig 4 shows that there is no unique mode for complaints so there is a chance of data lost; complain not reach to CED department in a specific time, late response by CED department and some time technician also complain that equipment not present at a particular site or location.

The user interface of MEMS is shown in Fig.5. The graph shows the working menu for CED department. It was designed by Visual studio C# and users operate the function on their computer browser. Different roles (such as clinical staffs, administrator, biomedical engineer etc.) have different authorities to open different functions.



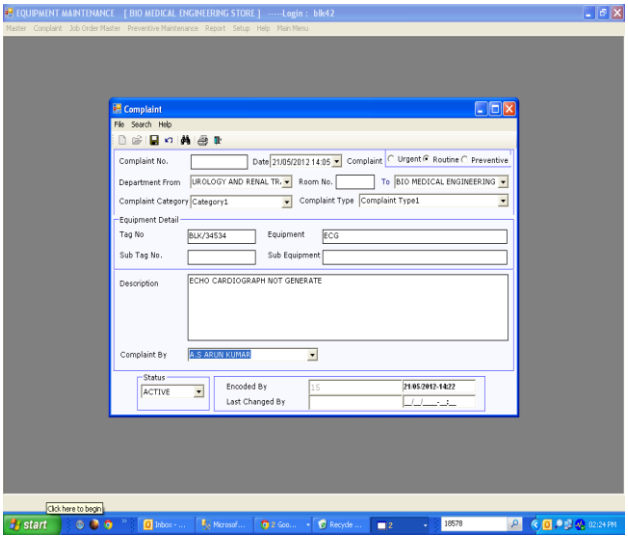


Fig. 5. The user interface of medical equipment management system

Fig 6 shows that through HIS we reduce or remove these errors in to CED department. By using HIS/MEMS in to CED department we easily know inspection and preventive maintenance schedule of equipment by set alarm system in HIS, complaint type , description of complaint, warranty period record, unique mode of complaint and compare between complain generate time and time taken for solution of complain for better use of equipment .

If we want to know what the error behavior for certain brand and model, we can set specific field on the query function of MEMS to get related information. The information can be used to prevent maintenance schedule or purchase assessment.

DISCUSSION

Our results demonstrated the ability of data analysis for maintenance history records with MEMS. It just uses the partial function of the MEMS in all operating activities of CDE. Fig. 3 shows an error analysis of one month maintenance records in 2012. It revealed a major problem that the lack of communication b/w department, in-proper data maintenance record of equipment and equipments was too old to be maintained and repaired in the hospital. To reduce the idle time during equipment shutdown, a stock plan is needed for some parts in general use and by using HIS complain system. Once the maintenance frequency of the equipments increases or the related parts are not available, a proposal for a new budget plan is needed.

Fig. 4 reveals an error analysis for specific type of complaint problem (data lost). These results provide useful information for managing strategies to medical equipment through HIS/MEMS. For example, in fig.4 we show that major problem is that there is no compliant reached at CED department in the cases of malfunction devices. To

prevent the problems, if we use HIS at the time complain generated from the any department for any malfunction devices complain automatically come in HIS system of hospital and come notice in head of CED department and we also make safety stock of these consumables should be kept to reduce the breakdown time during repair. Fig 6 shows that if we use HIS in CED department then we easily register compliant in system and also have complaint description for a particular compliant.

In many cases the CED is managed according to three approaches: totally internal, totally external and a combination between internal and external resources. In the initial design for developing the management system, it is necessary to consider the real operation mode of CED. In our system, which is designed for a combination type, the function of contract management is a sub-system for managing the outsourcing service especially for high value equipment, such as CT and MRI. In the sub-system, the service response time and the maintenance quality are the two important monitoring items. In this study, the MEMS cover all activities in CED on medical equipment management. Through systematic data collection in each stage (such as purchase, contract, repair, and maintenance), it provides useful information to advance the management ability in CED more effectively and efficiently. With regard to how to run data into useful information, however, the data format and operating interface are very important. They will influence the information whether is accurate and comprehensive. Data quality initiatives can help to insure the accuracy of clinical/biomedical engineering data. Some important key fields in designing database may be considered. For maintain good HIS system we need the basic information of medical equipment that should include: nomenclature, manufacturer, nameplate model, serial number, acquisition cost, condition code, and maintenance assessment. To record key date in working condition includes: accepting, assigning, ending, and retrieving case (fig 5). To record related person in these operating activities includes: user, engineer, manager, department chief, contact phone number, and related cost center code. The cost data is also important for modern enterprise, so the related cost value like purchase, installation, training, consumables, operating, maintenance, contract, and disposal needs to be involved. Other useful data could include: warranty, location, other contractor agencies, scheduled maintenance due dates, and intervals.

CONCLUSION

Medical equipment has become an important component of modern health services. But the related management or maintenance is particularly weak in the BLK hospital. The growth in capabilities to manage or maintain medical equipment has lagged far behind the rate of deployment of equipment. In addition to the traditional operation management, the patient safety, operation performance in cost/efficient analysis, and risk evaluation and control are the important issues for using medical equipment in hospital [11-12]. A framework of medical equipment management system has been proposed in the paper for assisting in-house CE department early to confront the potential risk. Through HIS we easily manage medical equipment in different department, different location in hospital. HIS helps CED department to manage complaint system in a proper manner so they quickly done solution for a particular complaint. Before implementation of HIS in CED department initially a training programme also conduct by the IT department of hospital.

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