Journal of Advances and Scholarly Researches in Allied Education
Vol. 18, Issue No. 4, July-2021, ISSN 2230-7540

Study on Maintenance of Medical Equipment and Challenges Faced By Health Care Technology Management System

Mukunda Choudhary[1]*, Dr. Vinay Pratap Singh[2]

[1] Research Scholar, CMJ University, Shillong, Meghalaya

[2] Assistant Professor, CMJ University, Shillong, Meghalaya

Abstract – Based on the research done in this study on how to manage medical equipment, it was discovered that hospitals lack a complete and codified strategy for how to manage medical equipment, resulting in a waste of material and equipment capital for the organization. When there is no planning and control system in place for inventory, purchasing, and maintenance of medical equipment, several difficulties arise, including the buildup and depreciation of equipment, as well as the inability to provide these facilities in crucial situations. It is advised that strategies be developed to replace equipment in critical situations (such as abrupt failure) based on the kind of equipment and the cost of replacement, as well as the equipment's vitality. There are protocols in place to verify the safety of medical equipment at several times, including before it is used on a patient, during a preventive maintenance programme, and after regular and significant repairs, all of which assist the hospital in planning and maintaining appropriate medical equipment

Keywords – Medical, Equipment, Health, Care, Technology

----------X----------

INTRODUCTION

The Maintenance of Medical Equipment at Care Hospital In India

The term "maintenance" refers to the process of keeping equipment in functioning condition or repairing it so that it may be used again. The primary goal of maintenance is to enhance the availability of production systems while also increasing safety and reducing costs. Medical technology refers to equipment used by health-care institutions for diagnosis, therapy, monitoring, rehabilitation, and other forms of treatment and care. Medical technology management is critical in the delivery of health-care services. To provide high-quality patient care, it is necessary to have comprehensive medical device management in place. The development of a maintenance schedule that takes into account the features and failures of medical equipment is critical in the management of technology. 4 Maintaining a profitable maintenance department is one of the most important levers of profitability available to any capital-intensive firm.

Medical equipment accounts for around 40% to 50% of total expenses in a tertiary hospital setting; nevertheless, even if the technology is cutting-edge at the time of purchase, it faces the prospect of certain obsolescence within 6-7 years of its installation. For capital-intensive enterprises, maintenance costs account for 40-50 percent of their total operating budget. This amount can be significantly decreased if new technology in the field of maintenance is made available to people. As a result, maintenance is sometimes the most significant single controllable expenditure for a company. It is critical that hospitals examine ways in which they might cut and better manage their operating expenses. National Health Systems Resource Center research has found that the dysfunctional rate in medical equipment can reach as high as 60% in some parts of the world, with the average dysfunctional rate in medical equipment ranging between 20% and 30% even in areas with a moderate presence of the medical equipment industry (e.g., the United States).

Healthcares in India

The health sector in India is divided into two parts: the government sector and the private sector. Health services provided by the government sector range from primary to tertiary level, and are provided at no cost to the consumer. The government sector provides publicly financed and managed curative and preventive health services from primary to tertiary level, throughout the country and at no cost to the consumer (these account for about 18 percent

of the overall health spending and 0.9 percent of the GDP). The private sector, on the other hand, dominates the provision of individual curative treatment through ambulatory services, accounting for around 82 percent of total health spending and 4.2 percent of total GDP. According to national health care consumption rates, private health services are primarily focused on delivering primary health care and are paid mostly via private resources, which may impose a disproportionate cost on the poor and the working poor. The duty for health in the government sector is divided into three categories. First and foremost, health is the primary obligation of the state. Second, the centre is in charge of health services in union territories that do not have a legislature. It is also in charge of developing and monitoring national standards and regulations, establishing links between states and funding agencies, and sponsoring a variety of programmers that are implemented by state governments across the United States. In addition, programmers included under the concurrent list are jointly responsible between the federal government and state governments.

The Current Situation on the Challenges Faced by Health Care Technology Management System

The World Health Organization (WHO) has worked hard to develop health policies and guidance (World Health Organization, 2011), and the Ministry of Health in every country has worked hard to ensure that hospital equipment is properly managed. However, there are many challenges to overcome, particularly in developing countries and rural areas. Hospital equipment performance was assessed to be 64.3 percent in Ghana, West Africa, according to . A report on the statewide inventory survey showed a lower proportion in many hospital equipment breakdowns, according to a report on the nationwide inventory survey. Among the difficulties associated with hospital equipment management, according to Zienaa (2009), there are the following:

1. Longer downtime of equipment. (Period of time that a system fails to provide or perform its primary function).
2. Hospital administrator's inadequate knowledge on importance on routine hospital equipment maintenance and service.
3. Absence or little budgetary support for maintenance.
4. The lack of the framework for regular auditing system.
5. Lack of knowledge and innovative ways of using new equipment.
6. Delayed fault reporting, example BP Apparatus patch up with plaster. g. The difficulty in obtaining spare parts. h. Failure to provide technical training to operators.
7. Obsolete equipment left unattended in maintenance room and wards.
8. The absence of evidence-based information system on health care technology for decision making.

OBJECTIVES OF THE STUDY

1. To study on Healthcares in India
2. To study on the Maintenance of Medical Equipment at Care Hospital In India

RESEARCH METHODOLOGY

The purpose of the research methodology chapter is to describe the techniques and processes that were employed to attain the stated objectives of the study in question. The objective of the current study was to establish and implement key performance indicators to assess the performance of MEMS in public hospitals, with the ultimate goal of improving patient care. As a result, the study was divided into two distinct phases: the development phase and the application phase, respectively.

RESEARCH DESIGN:

Study Design

The study is an empirical, descriptive and analytical in nature.

Study Population and Study Units

The study population and units included:

1. The specialists in the subject of Hospital Administration, include professors and researchers. It was also taken into consideration for the goal of validating the research instruments the opinions of doctors, technical managers, and biomedical managers were also taken into consideration.
2. The healthcare professionals (users) who are in direct contact with the medical equipment
3. The research units included a variety of diagnostic and therapeutic devices as well as monitoring devices and other basic, general, and supportive medical equipment.

Data Collection Tools

- A set of 30 templates for proposed KPIs, which were validated by the experts (Annexure IV).

- A self-administered structured questionnaire for getting information from the administrator and users of the medical equipment (Annex ure VI).

- Data was compiled in terms of scores. The positive response i.e., responses 'Yes' were considered as score=1 and negative response i.e., responses 'No" were considered as score=0. A comprehensive score of each participating hospital was prepared to assess the performance of MEMS.

DATA ANALYSIS

Utilizing statistical approaches, the validity and reliability of the measurement instrument were evaluated prior to its use. The results were positive. All of the objectives of the study were examined at the 0.05 level of significance, and the findings were computed in accordance with this. In order to compare the performance of four hospitals, a one-way ANOVA was performed. When attempting to determine the interrelationship between components of the conceptual framework, Pearson's correlation coefficient was obtained. For the purpose of determining the outcomes of secondary objectives, linear regression analysis was used. In this case, the value of UC was forecasted in relation to overall KPI scores as well as maintenance scores.

Table 1: Percentage Agreement amongst Experts

Attribute	Strongly Disagree	Disagree	Can't say	Agree	Strongly Agree	Percentage agreement
Specific	0.0	2.1	6.9	42.9	48.1	91%
Measurable	0.0	2.5	12.3	46.9	38.3	85.2%
Achievable	0.0	1.7	12.7	46.0	39.6	85.6%
Relevant	0.0	1.5	5.6	41.7	51.3	93.0%
Timely	0.0	1.9	11.0	52.3	34.8	87.1%

In addition to assessing the reliability of individual KPIs, the reliability of the comprehensive instrument (i.e., the sum of all KPIs) was evaluated. The dataset was separated into two parts for the purpose of calculating Guttman split-half dependability. Part one comprised of three attributes: 1 (specific), 2 (measurable), and 3 (indicative of overall quality) (achievable). Similar to part one, part two had three traits, namely attributes 3, 4, and 5 (which were all important).

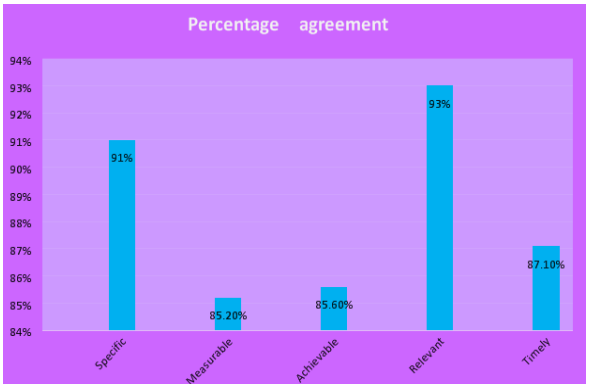

Fig. 1: A Comprehensive Percentage Agreement amongst Experts

Cronbach's alpha values varied from 0.77 to 0.98, while the Guttman split-half reliabilities of all agreed-upon KPIs fell between 0.78 and 0.95 on the Guttman split-half scale. The overall scale had the same values of 0.87 and 0.85, respectively, and as a result, it was deemed satisfactory for all of the agreed-upon KPIs. After doing one sample Kolmogorov Smirnov for hypothesis testing, it was discovered that the "p" value was less than 0.05, indicating that the null hypothesis was rejected . This demonstrated the statistical significance of maintaining all five distinct properties, namely specificity, measurability, achievability, relevance and timeliness, as the important components of all selected key performance indicators (KPIs).

Statistics were used to examine the total percentage agreement, reliability, and significance of all qualities. The findings revealed that all of the variables were good. Finally, a set of 28 key performance indicators (KPIs) was selected from a pool of 30 proposed KPIs based on their ability to meet the criteria of statistical testing. According to table 3, two key performance indicators, KPI no. 15 (Cost-benefit analysis) and KPI no. 17 (Utilization Pattern), were eliminated from the final collection of KPIs because they did not meet the minimal standards for reliability and hypothesis testing, respectively.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of attribute 1 is normal with mean 4 and standard deviation 0.500.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
2	The distribution of attribute 2 is normal with mean 4 and standard deviation 0.750.	One-Sample Kolmogorov-Smirnov Test	.018[1]	Reject the null hypothesis.
3	The distribution of attribute 3 is normal with mean 4 and standard deviation 0.500.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
4	The distribution of attribute 4 is normal with mean 4 and standard deviation 0.516.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.
5	The distribution of attribute 5 is normal with mean 4 and standard deviation 0.574.	One-Sample Kolmogorov-Smirnov Test	.000[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

[1] Lilliefors Corrected

Fig 2: Statistical Significance of SMART Criteria

Table 2: Coefficients of Predictors of UC; Multiple Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.919	.302		6.348	.000
Percentage PPM	.287	.095	.375	3.023	.003
Preventive Maintenance	-.087	.119	-.083	-.732	.465
Accuracy and Quality Control	.125	.093	.094	1.350	.178
Corrective Maintenance	.028	.092	.025	.310	.757

Testing and Results of Hypothesis Four:

To estimate the utilisation coefficient, a multiple linear regression model was constructed using the scores of Preventive Maintenance, Corrective Maintenance, Accuracy & Quality Control, and Percentage completion of the Preventive Maintenance programme. It was discovered that the regression equation F (4, 234) = 9.775, p =.00), with an R2 of.143, was correct. Because all factors were quantified in terms of numeric scores, the UC of the medical equipment under investigation was equal to 1.919 +.287 (Percentage completion of PPM). When the Percentage completion of PPM was enhanced by.287 points, the UC of medical equipment under investigation increased by.287 points.

The above regression model reveals that the percentage Completion of PPM was a significant predictor of UC (p =.03) according to the results of the study. When it came to predicting UC of medical equipment under investigation, the null hypothesis was rejected only when it came to the proportion of PPM that was completed. The null hypothesis was accepted for all other variables in the CM, PM, and Accuracy & Quality Control (p > 0.05) that were used as predictors of UC.

CONCLUSION

In order to address this problem area, the current study was recommended. A total of 30 key performance indicators (KPIs) were discovered, defined, and reported in relation to MEMS best practices. These were presented with consideration for the current situation of public hospitals. In order to convey their choices on a 5-point Likert scale, a panel of 16 experts from all parts of MEMS were recruited, including top hospital administrators, physicians and dental surgeons, biomedical engineers, technological specialists, and professors of hospital management. In addition, the researcher provided each expert with a collection of 30 potential KPI templates. In addition to these KPIs, 110 parts of MDS as well as a conceptual framework were given for expert review and approval. Their viewpoints were afterwards investigated and assessed using statistical methods, as outlined above. The validity and reliability of each suggested KPI, as well as all parts of MDS and the conceptual framework as a whole, were assessed using the information gathered through expert opinion. The percentage agreement among experts ranged from 85 to 100 percent for some KPIs and MDS items, depending on the item in question. Two key performance indicators (Cost-Benefit Analysis and Utilization Pattern) and 14 aspects of the MDS did not get 80 percent agreement, and as a result, they were rejected and eventually removed from the questionnaire. The comprehensive framework earned a content validity index of 0.93 as a consequence of the research conducted. Alpha coefficients and split half coefficients calculated by Craunbach were in the range of 0.82 to 0.95 for all domains of the framework in the study (Chaudhary, Singh, Satia, Sharma, & Ajmera, 2016).

REFERENCES

[1]. NYU Hospitals Center. (2006). Medical Equipment Management Plan (MEMP). Retrieved 14 January 2017, from http://webdoc.nyumc.org/nyumc/files/redaf/attachments/MEDEQUIP_0.pdf

[2]. Omachonu, V. K., & Einspruch, N. G. (2010). Innovation in Healthcare Delivery Systems: A Conceptual Framework. The Innovation Journal: The Public-Sector Innovation Journal, 15(1), 1-20.

[3]. Pardeshi, G. (2005). Medical Equipment in Government Health Facilities: Missed Opportunities. Indian Journal of Medical Sciences, 59(1), 13-19.

[4]. Patil, U. (2011). Quality in Imaging Services. Healthcare Quality Improvement. Retrieved 14 January 2017, from http://www.qcin.org/nbqp/conclave2011/Presentation/DrUday_Patil.pdf

[5]. Paul, C. (2016). Connecting Healthcare Operations with the Patient Experience. Intelligent InSites.

[6]. Retrieved 21 January 2016, from https://intelligentinsites.com/tag/medical-equipment-utilization/Performance Management and KPIs: Linking Activities to Vision and Strategy. Retrieved 23 April 2017, from http://www.mindtools.com/pages/article/newTMM_87.htm

[7]. Perry, L., & Malkin, R. (2011). Effectiveness of Medical Equipment Donations to improve Health Systems: How much Medical Equipment is broken in the Developing World? Medical & Biological Engineering & Computing, 49(7), 719-722.

[8]. Saleh, N., & Balestra, G. (2015). Comprehensive Framework for Preventive Maintenance Priority of Medical Equipment.

Engineering in Medicine and Biology Society, 2015(37), 1227-1230.

[9]. Sedgwick Fincher, D. E. (2016). Still Waiting: Is it time to empower Patients with an Enforceable Right to timely Elective Surgery? (Doctoral dissertation, Queensland University of Technology).Retrieved 14 January 2016, from https://eprints.qut.edu.au/101095/1/Deanna_Sedgwick%20Fincher_Thesis.pdf

[10]. The Innovation Value Chain. (2007). Harvard Business Review. Retrieved 14 January 2017, from https://www.researchgate.net/publication/6255929

[11]. Theodorou, M., Georgiou, M., Nikolentzos, A., & Bellali, T. (2015). Reconsidering Planning and Management of Medical Devices Procurement in Public Health Services in Cyprus. Global journal of health science, 7(6), 205-214.

[12]. U.S. Department of Health and Human Services. (2011). Managing Data for Performance Improvement: Health Resources and Services Administration. Rockville, Maryland: Evans, M.Retrieved 18 January 2016, fromhttps://www.hrsa.gov/quality/toolbox/pdfs/managingdataforperformanceimprovement.pdf

Corresponding Author

Mukunda Choudhary*

Research Scholar, CMJ University, Shillong, Meghalaya