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BIOMEDICAL EQUIPMENT MANAGEMENT AND MAINTENANCE, A PROCESS EVALUATION AT A GOVERNMENT HOSPITAL – TELANGANA, INDIA

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ABSTRACT

Modern hospitals with a super-specialty level of care facilities rely largely on medical gadgets, the biomedical equipment to offer precision care to their patients both for medical and surgical treatment options. This highly specialized equipment requires proper maintenance and care in terms of calibration to provide accurate information about the patient vital signs that are crucial for their diagnosis and line of care. It becomes necessary for a systematic procedure for their management and maintenance – here comes the importance of biomedical equipment management and maintenance program devised by Government of India to enhance the public healthcare facilities through proper preventive and breakdown maintenance of their biomedical equipment, thereby to enable doctors to get reliable information for their patient care. The present study aims at the evaluation of this prime program implementation results from the end-users of a tertiary care teaching healthcare facility in Telangana state.

End users expressed their opinion that 16.6% felt the services are excellent after the introduction of BMMP services, 33.7% said GOOD after (22.0% before), 9.6% said SATISFIED after (18.9% before), 3.1% said POOR after (7.9% before) the introduction of Biomedical Equipment Management and Maintenance Program BMMP services.This is our original work, done by us and is not presented or published previously. We have no conflict of interest

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3. Professor and Head, Department of Hospital Administration, Gandhi Medical College &Hospital, SecunderabadEnd users opined that 30% of equipment was being repaired in≤1 month, 70% of the equipment take about ≤ 1 month for the repair of biomedical equipment before BMMP. They opined that 40% of equipment is being repaired ≥ 15 days, 30% of the equipment is repaired ≤ 15 days, about 20% of biomedical equipment is repaired within weekdays and about 10% of biomedical equipment is repaired within one day after the introduction of the BMMP program. These values are indicative and for study purpose only, there are instances of equipment being in the state of breakdown beyond one month also – which were with the instance of Annual Maintenance Contract / Comprehensive Maintenance Contract termination and no clear instructions were available with BMMP contractor for their renewal and maintenance of continual contracts and upkeep of these machines, which were otherwise looked after by Original Equipment Manufacturers OEMs through Memorandum of Understanding with the Hospital.

KEYWORDS :

INTRODUCTION:

Today modern hospitals which possess the super specialization medical and surgical facilities largely rely and take support of biomedical equipment to provide evidence-based treatment and care to their patients, right from the diagnosis stage of the patient condition, the selection of best available plan of care for their treatment to improve their health condition, bring them back to normal from their suffering and to enhance their quality of life. Medical gadgets or biomedical equipment took a vital role in health care; they started to play a major role in the practice of medicine in recent times.

By understanding the importance for management and maintenance of the biomedical equipment in delivery of care to the patients at the public healthcare institutions, the Ministry of Health and Family Welfare, Government of India has launched the program for their upkeep and minimization of downtime and has provided the standard guidelines named as Biomedical Equipment Management and Maintenance Program (BMMP) in the year 2015. This program is presently being successfully implemented in 28 States/ Union Territories of India to reduce healthcare delivery cost through an understanding with private partner expert in this domain and by entrusting the asset management and systematic upkeep of the biomedical equipment inventory presently available in the public healthcare institutions across the state through a single vendor contracting system [1].

National Health Systems Resource Centre (NHSRC) was established in the year 2006 with a clear objective to assist the State Governments for the development of the standard policy and strategy through the provision of support by mobilization of technical assistance and capacity building [2]. Their aim for this program is to prepare a master database of all the biomedical equipment available in the public healthcare institutions, to tag each one of the equipment with the unique identification number for smart tracking.

Comprehensive equipment history and their operational performance both in terms of downtime and maintenance cost can be monitored through real-time by using a software module which is developed for monitoring the entire biomedical equipment at State Government Hospitals, through the smart governance system. A centralized call center is established at the state headquarters to receive equipment related complaints from across the spectrum of healthcare institutions and log their complaint in the central server, which prompts the service engineer stationed at the field level to attend the call and fix the problem at the earliest.

The core objective of this program is to increase the efficiency of available equipment by reducing their downtime and to ensure optimal operational efficiency for the care of the patients visiting these facilities. Reliability about the information provided by these biomedical equipment attached to the patient can be assured by embracing a

scientific management system of preventive maintenance and calibration for precession accuracy of diagnostic information, which presently needs to be improved at these facilitates [3].

CONTEXT AND AIM:

Healthcare in India is provided by Hospitals managed by Government sector and Private players, the majority of rural healthcare facilities are in the control of State Government and majorities of Private Hospitals are concentrated in the urban conglomerate. The estimated bed distribution for pan India Hospitals is shown in the table below [4].

Sr. No	Hospitals Type	Bed Count (in Million)	Bed Count Percentage
1	Government	8.6	59.7
2	Private	5.8	40.3
3	Total	14.4	100.0

Telangana is the 11th largest state in terms of land area and 12th largely populated state situated in the south-central region of the country. Hyderabad is the capital city of Telangana state; it is 4th largest metropolis in the country in terms of population density. 19% of the state population lives in Hyderabad making it one of the prime destinations of the country. Hyderabad is a cosmopolitan city with a representation of people from pan India and students from pan Asia who study at the Universities situated here. Healthcare in Hyderabad is at the Tertiary level in Government institutions comprising of postgraduate level teaching medical college Hospitals and Quaternary at the corporate Hospitals which offer the care of treatment comparable at par with the developed nations.

Biomedical Equipment ranging from the simple vital sign monitoring to the sophisticated organ functioning systems to enable organ transplantations are available in the healthcare industry and are now used for swift diagnosis, impeccable surgery, and therapeutics, etc. The use of a malfunctioning Biomedical Equipment may result in faulty diagnosis and wrong treatment and can lead to damaging or even devastating aftermath. There is a need for an enduring mechanism that can maintain and repair the biomedical equipment routinely before use and this can be done only with the help of qualified Biomedical Engineers. Thus there is a sincere need for a well-organized cadre of Biomedical Engineers with specialization in medical instrumentation. The organized system of BMMP should be made responsible for the maintenance and proper functioning of Biomedical Equipment at the public healthcare provider institutions which are effortlessly striving for the healthcare services of the BPL populations relying on these facilities for their healthcare needs.

The BMMP program is aimed at the development of the system to:

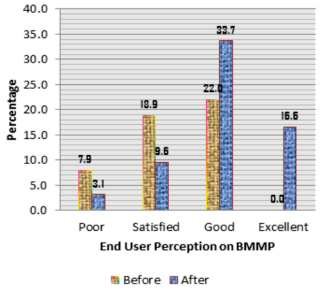
- Design and development of a comprehensive computerized database for Biomedical Equipment at Public Healthcare Institutions
- Professional monitoring by the Biomedical engineers
- Online UI tag and maintenance module
- Farsighted managerial skill to maximize accuracy, functioning, and cost-effectiveness for maintenance and management [5].

END USER PERCEPTION:

Following table shows the information received from the end-user of Biomedical Equipment at the tertiary care level government teaching medical college hospital at Telangana, Hyderabad with their level of satisfaction before and after the implementation of BMMP program using a Likert Scale 1 being Not Satisfied and 10 being Highly Satisfied for a range of operational and maintenance issues.

End user perception before and after BMMP Program - Figures in Percentage Value

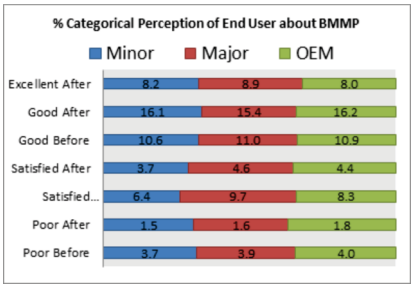
Sr. No	Work Request	Remark	10 Point LIKERT Scale (1 Not Satisfied - 10 Highly Satisfied)									
			1	2	3	4	5	6	7	8	9	10
1	Response to Breakdown Call	Before			6.12	24.49	40.82	12.24		16.33		
		After								36.36	40.91	22.73
2	Upkeep in desired time	Before			10.71	7.14	8.93	32.14	12.50	28.57		
		After				5.26	6.58	7.89		21.05	59.21	
3	Arrangement of Spareparts	Before			4.23		7.04	8.45	19.72	22.54	38.03	
		After		3.13		6.25	7.81	18.75	21.88	12.50	14.06	15.63
4	Professional knowledge	Before			10.71	14.29	17.86		12.50	28.57	16.07	
		After								36.78	51.72	11.49
5	Quality of work	Before					15.63	37.50	21.88	25.00		
		After					6.33	17.72		30.38	45.57	
6	Downtime	Before	≥ 1 Month		70.00	≥ 15 Days		30.00	7 Days		1 Day	
		After	≥ 1 Month		30.00	≥ 15 Days		40.00	7 Days	20.00	1 Day	10.00



FINDINGS:

Biomedical Equipment Management and Maintenance Program Biomedical Equipment Management and Maintenance Program Biomedical equipment maintenance program at the public health institutions is evaluated using a structured questionnaire to collect the information about the response to breakdown calls, upkeep of machine under breakdown within the desired period, time taken by service agent for arrangement of required spare parts in the biomedical equipment, professional knowledge and inspection by the service agent to find out the root cause for the repair, quality practice by the service agent, overall downtime of biomedical equipment, using a standard tool with 10 pints LIKERT scale – 1 is not satisfied and 10 is highly satisfied from the end-users both after implementation of BMMP program and the practice followed before BMMP program.

It is learned from the study that the end-users at the public healthcare institution expressed their opinion that 16.6% felt the services are EXCELLENT after the introduction of BMMP services, 33.7% felt the services are GOOD after the introduction of BMMP services, 22.0% felt the services were GOOD before the introduction of BMMP services, 9.6% felt the services are SATISFIED after the introduction of BMMP services, 18.9% felt the services were SATISFIED before the introduction of BMMP services, 3.1% felt the services are POOR after the introduction of BMMP services, 7.9% felt the services were POOR before the introduction of BMMP services.



End users opined that 30% of equipment was being repaired less than or equal to one month after the introduction of the BMMP program whereas there were 70% of the equipment that use to take about less than or one month for the repair of biomedical equipment. They opined that 40% of equipment was being repaired less than or equal to 15 days after the introduction of the BMMP program whereas there were 30% of the equipment that use to take about less than or equal to 15 days for repair of biomedical equipment. About 20% of biomedical equipment is repaired within weekdays after the introduction of the BMMP program. About 10% of biomedical equipment is repaired within one day after the introduction of the BMMP program. Categorical opinion for MINOR equipment repair, MAJOR equipment repair and equipment repair with the help of service agent from ORIGINAL EQUIPMENT MANUFACTURER is shown in the graph both after implementation of the BMMP program and before in the terms of end-user experience. These values are indicative and for study purpose only, there are instances of equipment being in the state of breakdown beyond one month also – which were with the instance of Annual Maintenance Contract / Comprehensive Maintenance Contract termination and no clear instructions were available with BMMP contractor for their renewal and maintenance of continual contracts and upkeep of these machines, which were otherwise looked after by Original Equipment Manufacturers OEMs through Memorandum of Understanding with the Hospital.

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