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Review Article

Assessment of Computerized Medical Equipment Management and Maintenance System From Health Technology Assessment (HTA) Perspective: Need and Approach

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Abstract

Appropriate management of medical equipment is of crucial importance for providing quality healthcare. A computerized maintenance management system (CMMS) is a computerized program used by healthcare technology management (HTM) systems as an instrument for maintaining, organizing, storing, and reporting the data related to medical technologies in health facilities. Though CMMS is introduced as a beneficial and flexible tool for transforming the management of biomedical equipment, but no evidence of the same has been documented yet to highlight the efficacy of CMMS in the Indian context. CMMS, an e-Health system used by HTM programs, is a relatively new technology being adopted by various states of India. Such systems are vital to judging whether the system is operating and delivering the effects as desired. Assessment not only can inform policy-makers about what is known about the technology, but it also provides a better knowledge of the strengths and weaknesses of the intended technology. Health Technology assessment (HTA) is a systematic process designed to synthesize and evaluate the prevailing evidence for treatment or health delivery innovation. So considering the HTA perspective, an assessment approach to CMMS could be planned. Systematic reviews and empirical frameworks that have been used for understanding and assessing e-health programs can be used for evaluating technologies. Assessment of CMMS from a HTA perspective should be vital to the implementation of HTM systems by healthcare agencies.

Keywords: HTA; CMMS; Medical Equipment; e-Health; Healthcare Sector

1. Context

Medical equipment requires regular maintenance, timely repair, and training for users. These equipment are specifically used for diagnosis, treatment, and rehabilitation (1), which indicates their critical importance for healthcare services. Equipment should be properly maintained in order to fulfill their objectives (i.e. providing quality health care) (2, 3). Inventory forms an essential part of effective healthcare technology. Medical equipment assets inventory is a comprehensive data collection of all equipment assets in healthcare settings (4). An effective inventory is important, as it can provide a big picture of the actual status of medical equipment within the healthcare facility. Besides, it plays an important role in assisting with various healthcare technology management (HTM) activities (5, 6). A bio-medical equipment management system helps in the management of equipment comprehensively from purchasing to replacement or discarding. This management can be carried out via the conventional pen-paper method or computerized system (7).

Recent trends in the growth of biomedical equipment services and the increasing use of electronic devices have raised the need for an enhanced biomedical equipment maintenance system that not only is a well-planned and managed program, but also keeps the equipment reliable, safe, and available for use when needed (8).

A computerized maintenance management system (CMMS) is a computerized program used by HTM systems as an instrument for maintaining, organizing, storing, and reporting data for medical technology in health facilities (5). It systematizes and documents all activities related to medical devices, including planning, inventory, preventive maintenance, service contracts, and alerts (9). The collected data can be examined and used for technology management, quality assurance, work order control, and budget management of medical devices (9). CMMS

can potentially improve the overall functionality and management of medical equipment at the facility level (9, 10). It manages the information regarding equipment inventory, service history, records about costing, performance, and preventive and maintenance procedures (9). CMMS comprises sections, tables, and segments that contain the equipment data from a given facility that can be analyzed and manipulated for the generation of reports in order to help policy-makers in reaching decisions relating to health technology (9).

CMMS may prove to be a very beneficial and flexible tool with enough capacity to transform the management of medical equipment, besides improving its availability and functionality, which are necessary to prevent, diagnose, and treat illness (7).

2. Need for Healthcare Technology Assessment

In the context of India, the current biomedical equipment maintenance has been initiated in a computerized manner in few states such as Rajasthan (e-Upkaran) and Gujarat (EMMS) with the key features of equipment commissioning and decommissioning, AMC (annual maintenance contract) records, complaint monitoring, equipment status monitoring, preventive maintenance, and breakdown details (11, 12). Though CMMS has been introduced as a beneficial and flexible tool for transforming the management of biomedical equipment, but no evidence of the same has been documented yet to highlight the efficacy of CMMS in the Indian context. The Biomedical Equipment Management and Maintenance program (BMMP) also aims to ensure upkeep time for medical equipment in Primary Health Center (PHC)/Community Health Center (CHC)/District Hospital (DH) at 85%, 90%, and 95%, respectively, in order to reduce the dysfunctional equipment (1). Assessment of CMMS is needed to find out whether it can comply with this aim of BMMP. Assessment of CMMS is also needed to find out whether it has been actually successful in terms of improving information quality, use, and net benefit, and for appraising the associated challenges and benefits associated in comparison to the traditional pen-paper-registry.

World Health Organization (WHO) Medical Device Technical Series provides a guiding instrument for healthcare staff, especially biomedical and clinical engineers, to implement a computerized method for managing their maintenance system. However, sufficient evidence is not available to develop strategies for assessing the performance of operating CMMS adopted by health facilities or agencies (9, 13-15). It is of utmost importance to know whether the adopted CMMS produces the desired result or not.

Moreover, surveys performed in developed countries found that around 94 percent of users of CMMS have failed to utilize CMMS to its fullest capabilities (16). CMMS systems might have various features that users might not necessarily use or may avoid using due to their unfamiliarity with the features, irrespective of those features having the potential to improve productivity. Underutilized CMMS functions can also pose a challenge in achieving the objective of biomedical maintenance programs (16). Our literature review showed that CMMS systems fail to reach their full potential because of inappropriate choice of the CMMS, management support, employee turnover, training, follow-up and monitoring, and vendor support for the CMMS (17, 18).

3. Approaches for Healthcare Technology Assessment

CMMS, an e-health system used by HTM programs, is a relatively new technology being adopted by various states of India. Assessing the performance of this system and evaluating whether it can produce the desired results is necessary. Such assessments not only can inform policy-makers about what is known about the technology but also provide a better knowledge of the strengths and weaknesses of the intended technology (19-21). HTA is a systematic process designed to synthesize and evaluate the prevailing evidence for treatment or health delivery innovation (22). So considering the HTA perspective assessment approach to CMMS could be planned. Systematic reviews can be used to highlight the efficacy of CMMS in terms of improving information quality and its application. Further, empirical frameworks that have been used for understanding and assessing e-health programs can be used to assess this technology (22). Benefits evaluation (BE) framework (Lau, Hagens, & Muttitt,2007), clinical adoption (CA) framework (Lau, Price, & Keshavjee, 2011), clinical adoption meta-model (CAMM) (Price & Lau, 2014), e-health economic evaluation framework (Bassi & Lau, 2013), Pragmatic HIT evaluation framework (Warren, Pollock, White, & Day, 2011), and holistic e-health value framework (Lau, Price, & Bassi, 2015) are such empirical frameworks, which provide a pathway to conceptualize, define, and envisage the factors and processes that influence the design, implementation, use of e-Health programs in a healthcare setting (22).

4. Conclusions

It seems that computerized systems are the need of the hour for managing medical equipment. Such systems not only have the potential to make the system more efficient but also are essential to know whether the adopted CMMS produces the desired results or not. Comparative assessments are required to evaluate various kinds and classes of CMMS in different health care settings. Assessment of CMMS from the HTA perspective should be integral to the adoption of HTM systems by healthcare organizations.

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