Chapter 20

Healthcare Technology Management

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Introduction

Technologies play a significant role in healthcare, and their effective management is crucial to the realization of quality healthcare. Healthcare technology management (HTM) is the systematic process of planning for and managing healthcare technology assets to enable the highest quality of care at the best cost. These tasks are multidisciplinary in nature and are carried out by qualified healthcare professionals, typically clinical engineers in partnership with others (Dyro, 2004). The overall goal of HTM is to ensure that the appropriate technologies are deployed to solve healthcare problems using suitable, cost effective, safe, functional equipment at minimal risk to users, patients and the environment.

This chapter provides an overview of the functions of HTM and concludes with some considerations for HTM in Africa.

Healthcare technology management functions

The HTM role includes finding ways to produce, procure and implement technology that is not only cost-effective but also complies with manufacturing, government, health and safety requirements. For healthcare facilities, this implies ensuring that the most cost-effective technology that makes the best use of the available resources is acquired (Bronzino, 1992) and managed for optimal performance to provide the health services mandated. The procurement and replacement of healthcare technologies require technology assessment for the identification of suitable equipment. Infrastructure and equipment installation projects require effective project management. Proper management of assets is required to achieve optimal utilisation of equipment. Appropriate and effective use of healthcare technologies can only be achieved if technical and medical personnel receive adequate training in operating and maintaining equipment. These main functions of HTM are described in further detail in the sections below.

Healthcare technology assessment

Healthcare technology assessment is a systematic approach to the identification of technologies that are applicable to a given health problem (Banta, 2003). It also examines the short and long-term consequences of the application of a healthcare technology

DOI: http://dx.doi.org/10.15641/0-7992-2544-0
https://openbooks.uct.ac.za/bmeafrica

(Sullivan et al., 2009). The WHO (2014) describes healthcare technology assessment as systematic evaluation of both the direct, intended consequences and the indirect, unintended consequences of health technologies. Such evaluation informs policies and decision making regarding the use of technology in health care. Healthcare technology assessments are conducted by interdisciplinary groups through the utilization of explicit analytical frameworks that draw from a variety of approaches that include but are not limited to epidemiology and clinical and health economics (Dankó, 2014).

Healthcare technology assessments are carried out for various reasons; for example, ensuring that healthcare technologies conform to regulatory standards for quality, safety and performance, determining if the technologies comply with design and production process requirements (Vincent et al., 2015) and ensuring that they produce the desired health gain and offer value for money (WHO, 2014).

Project management

Project management is the management of temporary activities within specific duration, cost, quality and risk parameters to achieve desired objectives. Of interest to HTM are infrastructure and technology related projects. Examples include the design and construction of healthcare facilities and the installation of equipment.

The application of project management to healthcare processes and structures is important as it enables healthcare facilities to run more efficiently, the direct result being more affordable and higher quality of care to patients. Research articles have been published on the application of project management techniques in healthcare in African settings. For example, researchers in Nigeria have developed a model for minimizing project time, cost and risk based on specific constraints in an X-ray machine installation project (Nwaneri & Anyaeche, 2014). The purpose was to find the most efficient project schedule that balanced project parameters.

Asset management

Healthcare technology assets represent significant capital expenditure. The management of these valuable resources towards ensuring that healthcare technology is selected appropriately, used correctly and to maximum capacity, and lasts as long as possible, is a financial imperative (Gaylin et al., 2011) as healthcare technologies are important and integral components of the healthcare service delivery system. Quality healthcare services can only be provided when these technologies are in good working condition to provide a fully functional and operational environment (Erasmus, Poluta & Weeks, 2012). Thus, the effective management of healthcare technology contributes to increased health sector efficiency, and ultimately to improved health outcomes and to a sustainable health service.

Healthcare technology asset management is implemented through a coordinated set of practices and procedures. Monitoring and understanding the lifecycle of healthcare technologies allow management to forecast when to introduce a new service or product to achieve the delivery of effective and transformative healthcare. Effective asset management ensures that healthcare technology equipment is subjected to rigorous safety and performance testing prior to initial clinical use, after repair, as well as routinely according to a schedule. One of the essential instruments used in the management of healthcare technology is an asset register, which provides up-to-date records on the physical location of the device, the actual state of the device, i.e. whether it is functional or not, and the availability of spare parts.

Asset management also includes the responsibility of deciding how best to maintain a healthcare facility's equipment. This can be in the form of in-house maintenance, utilisation of vendor or manufacturer services on a contractual or an as-needed basis, and/or through maintenance insurance (Bronzino, 1992). It is assumed that responsible personnel are equipped with the relevant management skills and technical expertise that allow them to determine the optimal lifespan of health technologies and manage the replacement and upgrading of equipment.

Technical education and training

Effective HTM requires that users of medical equipment are adequately trained in, and informed about potential risks associated with, the use of healthcare technology; thus users should receive periodic operator training in addition to their initial training on newly acquired or unfamiliar equipment; this may be from in-house departments or outsourced service providers (Bronzino, 1992).

Healthcare technology management in Africa

A discrepancy in the coverage of essential health care services is especially evident between developing and developed countries, particularly in the development and management of, and access to, healthcare technology (Erasmus, Poluta & Weeks, 2012). Availability, geographical access, acceptability and affordability are some of the barriers that affect developing and low income countries (Jacobs et al., 2011) and hamper healthcare technology implementation, utilisation and innovation. The poor and marginalized in these countries are even less likely to receive effective healthcare than the better off who have the alternative of engaging in medical tourism (O'Donnell, 2007). This is in stark contrast to sustainable development goal number 3 (SDG3) of good health and well-being for all at all ages (WHO, 2015).

A study on HTM governance by Houngbo et al. (2017) in Benin provides an illustration of such challenges. The authors identified many flaws inherent in Benin's HTM system and specifically cited high prices paid by the government for health technologies. They also

identified other challenges such as insufficient staff to manage equipment and monitor supplier prices, unavailability of spare parts, lack of maintenance budgets, and unequal distribution of equipment across health care facilities. The majority of stakeholders interviewed in the study believed the country's HTM system was deficient in all respects. Furthermore, they found that the relevant policy makers were not forthcoming in addressing HTM problems and that a high degree of politicization influenced public sector decision-making.

Such conditions are prevalent in many African countries. The Ouagadougou Declaration signed by 46 ministers of health in Africa has proposed a framework that outlines generic interventions for addressing the health systems challenges faced by the African countries (WHO. AFRO, 2008). For health technologies, the framework proposes the development of formulae for the purpose of determining the requirements and forecasting of essential technologies and infrastructure; and the creation of transparent and accountable procurement systems.

In order to address the healthcare technology challenges of low-and-middle-income countries in Africa, the implementation of this framework requires training of biomedical equipment technicians, clinical engineers and biomedical engineers; these professionals play complementary roles in supporting effective healthcare delivery (Mohedas et al., 2015). Clinical engineers play a critical role in HTM implementation and in advancing patient care, through the application of engineering and management skills to healthcare technology (ACCE, 1992; Hossain et al., 2015) their functions include design and development of medical devices, maintenance, project management, education, safety, development of healthcare systems, and asset management (Bronzino, 2014). Biomedical equipment technicians "support, service and repair medical equipment including installation, calibration, inspection, preventative maintenance and repair of general biomedical and related technical equipment" (Mohedas et al., 2015:34).

While clinical engineers, biomedical engineering technicians and biomedical engineers may follow distinct training and career pathways, biomedical engineering degree programmes in African countries often have been introduced with the purpose of producing graduates able to satisfy the HTM needs of national health facilities, by training biomedical engineering technicians and clinical engineers. A recent survey of undergraduate engineering students in Ghana revealed that most of the students anticipated a career path related to HTM, particularly in the maintenance, procurement or sale of hospital equipment (Mohedas et al., 2015).

It is imperative for African countries to develop workable strategies to manage health technologies. A critical requirement is the presence in African hospitals of well-trained HTM personnel, who are able to assess technology needs, respond appropriately by procuring suitable technologies, and manage their implementation, utilisation and maintenance, for delivery of health services to suit population needs.

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