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Impact of Electronic Medical Records on Healthcare Delivery in Kisii Teaching and Referral Hospital

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Abstract

Despite electronic medical record (EMR) systems being in existence since 1972, it's only recently that governments worldwide have begun to encourage digitalization of medical records (Agency for Healthcare Research and Quality, n.d.). With EMR systems being the current way of hospital management and also delivering healthcare in Kisii Teaching and Referral Hospital (KTRH), there is need for a review of their impact and to understand the challenges faced in their adaptation and use. The objective of the study was to determine the impact of EMR on healthcare delivery in KTRH. A cross-sectional qualitative study was carried out in KTRH among healthcare providers. An interview guide was used to collect data which was coded and analyzed using content analysis. The study revealed that the EMR systems have led to an increase in the productivity of healthcare delivery, better clinical decision making and better collaboration between healthcare providers. The major challenges identified were shortage of funding for the adaptation and utilization of the EMR systems, computer illiteracy among staff and shortage of ICT staff in the facility. The EMR systems in KTRH have had a great impact on health care delivery system by increasing collaboration between personnel, increased productivity of health care providers bringing about patient and provider satisfaction. There is need to increase the amount of funding for the utilization of the systems, to employ more ICT staff and carry out refresher training to the staff so as to increase the benefits of the EMR systems and tackle the shortcomings.

Keywords: Electronic medical record; Digitalization; Impact; Productivity; Healthcare delivery

Introduction

An EMR system is defined as an electronic record of health related information on an individual that can be created, gathered, managed and consulted by authorized clinicians and staff within one health care organization. They have the potential to provide substantial benefits to physicians, clinic practices and health care organizations (Agency for Healthcare Research and Quality, n.d). [1] another term used interchangeably with EMR is the Electronic Health Record (EHR) that are digital records of health information that offer more functions than EMRs as they focus on a patient's total health not just the standard clinical data.

Background of the study

Despite electronic medical record (EMR) systems being in existence since 1972, it's only recently that governments worldwide have begun to encourage digitalization of medical records. In Kenya, the Ministries of Health (MOH), i.e., the Ministry of Medical Services and the Ministry of Public Health and Sanitation, are actively promoting the standard implementation of EMR systems with the aim of improving health care delivery, health systems management and patient health outcomes. Several EMR systems exist in Kenya to collect and manage data, analyze data, manage patients or hospitals, provide administrative/management support and to manage external systems such as supply chain management.

Statement of the problem

Since the adaptation of EMR systems, numerous reviews for example (Ministry of Health Kenya, 2011) [2], have the systems not to address the minimum functional requirement categories which the EMR Standards and Guidelines for Kenya (ESG) deem important for defining standards for EMR systems. With EMR systems being the current way of hospital management and also delivering healthcare in KTRH, there is need for a review of their impact. This study aims at reviewing

the functional uses and getting to know the impact of the EMR systems in KTRH.

Justification

Despite there being reviews on the EMR systems, there is limited knowledge on the perception of healthcare providers who use these systems especially in Kenya. This study aims at bridging this gap in knowledge in the field of health informatics in Kenya. The findings of this study have the potential to inform development of guidelines for upgrading the systems to meet international standards.

Research objectives

Broad objective

To determine the impact of EMR on healthcare delivery in Kisii Teaching and Referral Hospital.

Specific objectives

- To determine the types of EMR systems used in KTRH.
- To evaluate the utilization of EMR systems in KTRH.
- To determine the benefits of EMR systems in KTRH.

Materials studied

Despite the great emphasis of utilization of EMR systems nowadays, the first EMR was actually developed in 1972 by the Regenstreif Institute, research institute in Indianapolis, Indiana. It was welcomed as a major advancement in healthcare/medical practice. Due to the high costs, this EMR wasn't as widely used as anticipated and was primarily utilized by government hospitals [3]. Into the 1990's, personal computers were becoming more affordable and the internet emerged. These innovations allowed for faster, easier access to information and the introduction of health information online-setting the stage for web-based EMR [4].

EMR Systems being utilized

The most widely used EHRs/EMRs by physicians according to Medscape's EHR report are Epic with 23%, Cerner with 9%, Allscripts 10%, eClinicalWorks with 6% and NextGen with 6% [5]. In Kenya the EMR systems used in various private and public hospitals include Comprehensive Patient Application Database (CPAD), IQ Care, Care 2000, Funsoft, Compact, Open Medical Record System (OpenMRS), etc., [2].

Functions of EMR systems

EMR systems were first developed for purposes of recording patient information. This was the case with Larry Weed's Problem Oriented Medical Record in the 1960's. According to the EMR Standards and Guidelines (ESG), EMR systems must address the following 6 key functional areas:

The first function is to record and provide basic demographic and clinical health information. This refers to patient-related information and includes patient identification information and clinic attendance or encounter information. EMR systems are required to collect and display essential demographic patient information and clinical information for example collect and display patient medication, collect and display patient allergies, collect and display test results, accept encounter clinical data: vital signs, weight, height, calculate BMI and accept clinical notes in structured format and in free text format [6].

The second function is to provide a clinical decision support. EMR systems are required to highlight abnormal test results, alert provider of abnormal (outside the normal range) vital signs, alert provider if a known allergic drug is prescribed or if a known drug interaction is likely to occur and provide reminders of recommended care due such as tests due and medication due [6].

The third function is order entry and prescribing. Order entry is the process by which a health care worker electronically enters instructions for the care and treatment of patients under his or her care. EMR systems are required to allow providers to enter orders with required details, accept prescription orders, order and administer immunizations: capture dose, site given and manage referral orders with details of referring provider and referred-to provider [6].

The fourth function of EMR systems is to provide health information and reporting. One advantage of EMR systems is to improve the reporting and use of health information. To support this function, EMR systems are required to generate reports from clinical data to support quality improvement and to generate aggregate reports for submission to health ministries and other consumers [6].

The fifth function is to Support Security and Confidentiality. Health data security and confidentiality is fundamental to any EMR system to ensure that the privacy of patient data is maintained. EMR systems are required to have access control functions that limit access to health data to selected individuals, based on defined and document roles, maintain detailed audit trails of all events within the EMR system, follow defined standard practices on logins and passwords, ensure data protection by meeting requirements regarding data backup, recovery and documentation of systems and incorporate technical security functions in line with requirements regarding encryption and data transmission [6].

The last function of EMR systems is to facilitate exchange of electronic information. EMR systems co-exist with other systems in the health care setting. These include other EMR systems, laboratory systems and pharmacy systems. In order to promote inter-operability between systems, EMR systems are required to receive patient information as a clinical document using a recognized standard, generate patient summary information as a clinical document using a recognized standard and generate aggregate clinical care information using a recognized standard [6].

Impact of EMR systems on healthcare

The advancement in information technology has had impact in all sectors including healthcare that have helped in mitigating challenges facing healthcare today. These challenges include; reducing preventable errors, improving communication among health care providers and facilities, and controlling the cost of medical care [7]. Other benefits of the EMR systems identified include improved patient care, improved care coordination, practice efficiencies and cost savings, increased patient participation and improved diagnostic and patient outcomes [8].

Methodology

Study site

The study was carried out in the various departments of Kisii Teaching and Referral Hospital.

Background of study site

This study was carried out at Kisii Teaching and Referral Hospital in Kisii County, one of the 47 counties in Kenya. The county is sub-divided into 9 sub counties with a population of about 1,161,269 that is served by 32 community health units, 84 dispensaries, 28 health centers and 14 hospitals [9]. Kisii Teaching and Referral Hospital (KTRH) has a daily workload of 200 newly admitted patients and 400 outpatients, combined with a bed occupancy rate of 150% [10]. KTRH hospital began in 1960 as Kisii Hospital. In 2007 it became a Level Five (5) hospital and in 3rd November 2014 it was upgraded to a level 6 Hospital [11]. KTRH offers inpatient, outpatient, surgical, maternity, radiology, laboratory, physiotherapy and counseling services. There are also special clinics in the hospital. They include; pediatrics, dental, gynecology, obstetrics, eye clinic, internal medicine and psychiatry.

Study design

A cross-sectional qualitative study design was adopted.

Target population

The targeted population was the healthcare providers in Kisii County.

Study population

The population studied was the healthcare providers in KTRH.

Sampled population

Twenty healthcare providers were found to meet the eligibility criteria and participated in the study. These included ten nurses in charge, four physicians, chief pharmacist, chief radiologist, lab manager and three ICT, accounting and procurement staff.

Sampling techniques

Purposive sampling technique was used in the study.

Eligibility criteria

Inclusion criteria

- Healthcare providers using EMR systems.
- Healthcare providers holding administrative positions in the various departments.

Data collection

In-depth interviews were conducted with the participants. An interview guide that was adopted from Kenya EMR Preliminary Process Evaluation in 2013, was used to collect information. Notes were taken during the interviews.

Data analysis

Data collected was collated to ensure none of the information was lost or left out. Data was thereafter coded and analyzed using content analysis approach.

Ethical consideration

Approval to conduct this study was sought from Moi University Institutional Research and Ethics Committee (IREC). Permission to conduct the research within the hospital was requested from the medical superintendent and carried out thereafter. Each of the interviewed participants gave verbal consent prior to the start of each interview session.

Findings

EMR Systems used in KTRH

There are 3 EMR systems used in KTRH. These included; Funsoft that is utilized in all departments in KTRH, Laboratory Information and Management System (LIMS) used only in the laboratory department and Kenya EMR that is used in the Patient Support Center (PSC).

EMR Systems utilization

From the interviews with the various health providers it came out that the EMR systems are fully utilized in the hospital. The functionality of these systems was categorized according to department.

Outpatient department and special clinics (Pediatrics, Psychiatry, Obstetrics and Gynecology, Diabetes clinic, Dental clinic, Eye Clinic)

The functions of EMR systems used in these departments included; registration and clerking of patients, sending of radiological and laboratory requests, sending of drug prescription, raising of departmental internal requisitions and communication to other health care providers.

Radiology department

The radiology department used the EMR system to receive radiology requests from outpatient department and special clinics. It also used it to communicate to other healthcare providers through the system and raising of departmental internal requisitions.

Laboratory department

This department utilized two EMR system, funsoft and LIMS. These two systems were integrated so as to enable receiving of patients from outpatient and special clinics, billing of patients, sending of results, generation of workload reports, archiving of information and communication to fellow colleagues.

Pharmacy department

This department utilized the funsoft software to run its functions. Funsoft was utilized to dispense prescription to patients apart from civil servants where it is done manually, producing daily, monthly and annually reports, ordering of stock from main store, receiving drugs orders from the wards and raising of departmental internal requisition.

Inpatient department

This department also used funsoft. It utilized it to Order drugs for patients from pharmacy and discharging patients and production of discharge summaries.

MCH department

This department like the others utilized the funsoft EMR system. The functions of EMR systems are similar to those of outpatient department.

Patient support center

The EMR system utilized here was the Kenya EMR. Though it was not fully functional, it was used to record patient information and produce reports to the hospital and MOH. It was reported that it will become fully functional this September.

Accounts

Funsoft was the EMR system utilized in this department. Its main functions were billing, invoicing, and cash collection, budgeting and receiving of requisition forms from procurement department.

Procurement

Fun soft functions in the supplies and procurement department included; receiving of the internal departmental requisitions, keeping inventory of available supplies and receiving orders (pharmaceutical and non-pharmaceuticals) from other departments.

Advantages of EMR systems

The healthcare providers reported that there are advantages of the utilization of EMR systems in KTRH. First they have

helped on time management and order in the management of patients. It is also easier to retrieve patient's information and generate hospital reports. The EMR systems have ensured that confidentiality of patient's information has been upheld. There is better communication among healthcare providers due to the systems. Other advantages were; data was more legible and there was better accountability of funds and supplies.

Disadvantages of EMR systems

Despite the advantages noted above, there were some disadvantages that were raised. First the systems brought about health issues like eye impairment and back pain. It was also easy to manipulate another person's account. A common disadvantage raised was the failing of the system and network break up. Lastly some functions were not accessible.

Challenges in the adaptability and use of EMR systems

The following challenges were reported from the various departments; First the ICT department received little funding despite it being expensive to implement and maintain the system. The EMR systems were also not fully utilized as there are some functions that are not accessible. There was shortage of staff in the ICT department to run and maintain the system. Other challenges included insecurity of computer devices, incompleteness of filling out data, and widespread sharing of user password among healthcare providers.

Impact of EMR systems

According to the healthcare providers, the EMR had led to an increase in the general productivity in KTRH on healthcare delivery in that it brought about better clinical decision making in the management of patients and better collaboration between healthcare providers involved in the patient care. It was also reported to have led to the increase and betterment of quality of patient care at KTRH. These all brought about patient and provider satisfaction.

Discussion

EMR utilization

Since 2011 when the use of EMR started in KTRH, the hospital together with the county government have been trying to meet the set guidelines and standards for EMR systems. This has led to efforts being made in streamlining the functions of funsoft, LIMS and Kenya EMR so as to meet the set guidelines. It was noted that the EMR systems utilized did not support the clinical support functionality. This was attributed to lack of funds to support the upgrading so as to support this function. This was identified in the year 2014 where funsoft was ranked 0% in this same category [2]. Apart from patient identification, the EMR systems in KTRH to some extent successfully support order entry and prescribing, health information and reporting, supporting confidentiality and security and exchange of electronic information. These

functions have been made possible by the organized work flow among the various departments in KTRH. From the analysis carried out by the MOH, funsoft was given an average score of 65.4% where patient identification and clinical information functionality was given 66.7%, order entry and prescribing 100%, health information and reporting 100%, supporting confidentiality and security 62.5% and exchange of electronic information 28.6% [2].

Benefits and impact of EMR systems

Increase in the productivity of the healthcare providers and the hospital:

This was brought about by multiple factors. First there was a decrease in the turnaround time in the management of patients. This was due to the improved access to new, recently stored, and archived information and reduced transit time. Although healthcare providers reported that there was an increase in the input of patient data as compared to the use of paper, they did agree that overall there was a reduction in the time spent in the management of patients. Most physicians believed the EMR has improved the quality of time with their patients and the quality of documentation in the records [12].

Another factor was that there was ease of access of patient information and records. This was due to the reduction in the time of searching for files and charts as compared to the use of paper. Information that would take several minutes to hours to access was accessible in a span of several seconds. This helped to reduce the turnaround time and increase patient satisfaction as they spent less time receiving care. Also there was a reduction in the loss or misplacement of patient information as all information is saved in a server and external drives at the ICT department in KTRH. In a study in 1998, it was noted that there were less lost charts and easier access but increased time charting [13].

The ease in generation of reports both to MOH and the hospital has led to an increase in the productivity. With the use of EMR it is easier to generate daily, monthly and annually reports which made disease surveillance easy. This not only helps the hospital but also the County and MOH to come up with guidelines, projects and programs to deal with these diseases at the community level. EMR enables electronic data storage that employs uniform data standards that will enable health care organizations to respond more quickly to federal, state, and private reporting requirements, including those that support patient safety and disease surveillance [14].

Better collaboration between personnel

Better communication

The EMR systems have made communication hitches a thing of the past. This is due to their ability to support SMS, email and real time chatting which have enabled faster and better communication as queries can be sent directly to the department needed and responses are immediate. This has also enabled better management of the patients as solutions, ideas and other options can be discussed by the healthcare

team. In a study carried out in the United States found that the EMR had facilitated communication among clinicians and support staff within the practice. In particular, the e-mail messaging function enabled support staff to record patient telephone calls and messages directly into the EMR and forward them to the appropriate person [12].

Flow of information and Better clinical decisions

Better flow of information is another benefit brought about by the interconnectivity and integration of the EMR systems. Healthcare providers can access patient information and through discussion, make appropriate clinical decisions based on the patient history, demographic data, and clinical information provided. EHR contributes to faster, more accurate communication between providers within the hospital and between ambulatory and hospital settings [15]. The EHRs have also improved the peer review process. Easy access to time-stamped orders, dispensing information, and administration records has made it easier to identify the causes of errors. There is better information about what was communicated between clinicians, creating less opportunity for disagreements about which parties are responsible for decisions [15].

Accuracy of data

Accuracy of data produced from the EMR as compared to when it is through paper has greatly improved at KTRH. This is due to the fact that data now is more legible. It does not depend on how neat one's handwriting is. This has reduced the errors made by healthcare providers due to an illegible writing. Quality improvement staff say that having EHRs reduces errors related to use of handwritten orders (i.e., poor legibility) and helps patients read discharge instructions [15]. Physicians and care providers believed that the quality of documentation was unsurpassed - the records were complete, accurate, legible, and organized [5].

Improved quality of care

Patient satisfaction

According to the healthcare providers, the patients have reported positive feedback with regards to when the hospital wasn't using EMR systems as compared to now. This is due to the fact that the healthcare providers don't ask repetitive questions with every visit as their information on past visits are easily accessible reducing patients' frustrations. The EMR systems have also reduced the rate of corruption as money is not paid directly to the healthcare providers but through KCB Bank that has a number of agents throughout the hospital. The providers' use of the EHR satisfied patients' needs and goals and stimulated less negative emotions in participants [16].

Provider satisfaction

The health care providers are also reaping the benefits brought about by the EMR systems. The EMR systems have not only made their work easier through ease of access of patient information, medication lists and tests available but it has

made them more productive through the collaboration with other healthcare providers. The EMR systems have also helped in streamlining the functions and roles of the various healthcare providers as functionality of these systems are based on the roles provided. For example, funsoft has different categories for nurses, physicians, pharmacists etc. The providers who entered their notes directly into the EMR believed they were more productive, whereas those who continued to dictate their notes did not find that the EMR saved them much time. This was the case with the Kenya EMR as they had both paper and EMR forms of recording. Most physicians believed the EMR has improved the quality of time with their patients and the quality of documentation in the records [12].

Increased confidentiality and security of information

The healthcare providers reported there being an increase in the maintenance of confidentiality and security of patient information. This has been brought about by the provision of user specific accounts and passwords. This has also helped in tracking and tracing who is and has viewed patient information due to the user specific accounts. With the electronic record, each person accessing the record is recorded and date and time stamped, providing a record of all access to the patient's information which is not the case when it came to paper records [17].

Increased accountability of funds and supplies

Since the utilization of EMR system, the hospital has seen a big impact in the accountability of funds and supplies. This has been brought about by the collaboration between the hospital and KCB Bank. In the hospital, there is no department where one needs to pay to the healthcare providers leading to a reduction in the rate of corruption. Another feature that has helped is that there is tracking of supplies through requisition forms and order forms. This made it easy to utilize all the supplies to the maximum as they can easily account for them. These results coincided with a report written by Henrick et al. [18] as computerized systems have helped to track supplies, account for profits and losses, control inventory and process payroll.

Conclusion

The use of information technology in health is quickly gaining global popularity with many health persons adopting electronic health record management systems. Kenya has not been left behind in this revolution with systems like funsoft, LIMS and Kenya EMR just to name a few being in the market. Through the systems we have seen increased productivity in healthcare delivery, better communication among healthcare providers bringing about better clinical decision making and overall patient and provider satisfaction. Despite these great effects, there are some shortcomings that challenge the adoption and utilization of EMR systems like systems' downtime, funding, lack of computer proficiency and insecurity. For the full effects of these systems to be felt in

KTRH, there is need for these shortcomings to be dealt with and eliminated.

Recommendations

To the county government:

- There is need to increase the amount of funding to KTRH for the adoption and running of EMR systems.
- The government through the help and partnership of hospitals and private sector in Kisii County need to spread the use of EMR systems to the other levels (level 3&4) of hospitals for ease of referral and sharing of information among hospitals.

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