KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI, GHANA

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF HEALTH POLICY, MANAGEMENT AND ECONOMICS

USE OF ELECTRONIC MEDICAL RECORDS IN EMERGENCY CARE AT KOMFO ANOKYE TEACHING HOSPITAL IN KUMASI, GHANA

BY

ADWOA GYAMFI (BSc. NURSING)

JUNE, 2016

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A THESIS SUBMITTED TO THE DEPARTMENT OF HEALTH POLICY, MANAGEMENT AND ECONOMICS, COLLEGE OF HEALTH SCIENCE, SCHOOL OF PUBLIC HEALTH, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN HEALTH SERVICES PLANNING AND MANAGEMENT

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DECLARATION

I hereby do declare that except for references to other people's work which have been duly acknowledged, this piece of work is my own composition and neither in whole nor in part has this work been presented for the award of degree in this university or elsewhere.

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DEDICATION

This work is dedicated to my lovely husband Samuel and dear children, Christian and Jerry who have sailed with me through the tough times and moments endured throughout my course work and research.

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DEFINITION OF TERMS

Automated health records: All scanned health records

Bio-data: This comprises of patient's demographics and encounters.

Computerized-based Patient Record: This describes the individualized patient health information linked by a code.

Core implementers: This refers to the four main persons whose collective efforts brought about the adoption of KATH ED EMR project.

Electronic Health Records: The longitudinal health records with entries by health care practitioners in multiple sites where care is provided.

Electronic medical record: This is the electronic record of health-related information on an individual that is created, gathered, managed, and consulted by licensed clinicians and staff from a single organization who are involved in the individual's health and care.

Emergency Medicine Information Technology (EM IT) /Research Office): This is the engine room for the ED's EMR project.

Encounter: This refers to the category of patient's visit to the ED, which can be new or past.

End users: This comprises of all medical record staff, triage nurses and national service personnel at the EM IT/Research Office

Healthcare practitioners: All clinical and nonclinical staff involved in providing a holistic care to patients/clients within a care delivery organization. This is inclusive of nurses, doctors, biomedical scientists, radiologists, pharmacists, administrative staff and billing clerks.

Legacy data: Back log of data being scanned.

MedSpina: This is software that manages medical records, processes prescription writing, drugs database, practice management, statistical reports and financial accounting.

Motivation/incentives: Any form of token given to appreciate staff for the added workload.

ABBREVIATIONS AND ACRONYMS

AHR: Automated Health Records

ARRA: American Recovery and Reinvestment Act

ART: Antiretroviral Treatment

AVPU: Alert, Voice, Pain, Unresponsive

CSS: Cascading Style Sheets

CDO: Care Delivery Organization

CDR: Clinical Data Repository

CDSS: Clinical Decision Support/ Rules

CMV: Controlled Medical Vocabulary

CDs: Computer discs

CPOE: Computerized Practitioner/Physician Order Entry

CPR: Computerized-based Patient Record

DHIS: District Health Information System

DOB: date of birth (DOB)

ED: Emergency Department

HER: Electronic Health Records

EM IT: Emergency Medicine Information Technology

EMR: Electronic Medical Records

GHS: Ghana Health Service

HITECH: Health Information Technology for Economic and Clinical Health

HIPAA: Health Insurance Portability and Accountability Act 1996

HOD: Head of Department

HTML: Hypertext Markup Language

ICT: Information Communication Technology

ICPC: International Classification for Primary Care

ID: Identification

IT: Information technology

KATH: Komfo Anokye Teaching Hospital

KBTH: Korle-Bu Teaching Hospital

KNUST: Kwame Nkrumah University of Science and Technology

LAN: Local Area Network

MMRS: Mosoriot Medical Record System

MOH: Ministry of Health

NAHIT: National Alliance for Health Information Technology

NHIS: National Health Insurance Scheme

NSP: National Service Personnel

PACKS: Picture Archive and Communication Systems

PIH: Partners in Health

RAM: Random Access Memory

RBS: Random Blood Sugar

TEWS: Total Early Warning Signs

UPS: Uninterrupted Power Supply

USA: United States of America

VB: Visual Basic

VDU: Visual Display Unit

WAN: Wide Area Network

WHO: World Health Organization

ABSTRACT

Background: The use of paper for record keeping (manual system) has been the order of the day in almost all the health care facilities of resource poor setting countries such as Ghana. This system has presented numerous challenges. The use of Electronic Medical Records (EMR) however seeks to address many of such challenges if not all.

Main objective: The main objective of the study was to evaluate the use of EMR in Komfo Anokye Teaching Hospital's (KATH) Emergency Department (ED). The outcome of the study was intended to provide lesson learning to improve the existing system at ED of KATH and other health facilities with intention of setting up EMR system.

Method: The study was a non-interventional, descriptive cross-sectional study that employed the qualitative approach of research. The study population was twenty four involving four core implementers and twenty end users of KATH ED EMR. Semi-structured interview guides were used to collect data from the respondents. The interviews were manually recorded and analyzed thematically facilitated by manual analysis.

Results: The KATH ED EMR project had no funding and it has been piloted for three years. The ED staff doubled up as the EMR personnel. An open source EMR was freely downloaded and customized to meet the needs of the ED. The EMR database was composed of bio-data of patients which was accessible to end users with user identification and password. The facilitators for utilizing the system included the desire to improve emergency medicine practice through data persistency; availability of some logistics such as computers, scanners, printers, office space, open source EMR, local area network and external storage devices; involvement of ED's internal management committee; motivation; previous knowledge in information technology; capacity building and training. The project had constraints of funding, inadequate computers and

accessories, full time information technology experts, automatic data and power backups, data entry and limited office space. It was observed that with the provision of adequate human and financial resources the challenges of the project will be overcome and the adoption of the EMR improved.

Conclusions and recommendation: The KATH ED EMR was hybrid and the end users were basically nurses and medical record staff. The staffs were motivated in using the EMR. However, the implementation was confronted with logistics and human resource constraints. Therefore, financial support from KATH management towards the clinical EMR at the ED will be an enormous contribution for successful implementation of the ED's EMR

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CHAPTER 1

1.0 INTRODUCTION

1.1 Background Information

The National Alliance for Health Information Technology (NAHIT) defines electronic medical record (EMR) as the electronic record of health-related information on an individual that is created, gathered, managed, and consulted by licensed clinicians and staff from a single organization who are involved in the individual's health and care (Neal, 2008). Thus, the fully functional clinical EMR is an application environment composed of the clinical data repository, clinical decision support, controlled medical vocabulary, order entry, computerized provider order entry, pharmacy, laboratory, radiology and clinical documentation applications (Dobrev et al., 2008). This environment supports the patient's electronic medical record across inpatient and outpatient environments and is used by healthcare practitioners to document, monitor and manage health care delivery within a Care Delivery Organization (CDO). The data in the EMR is the legal record of what happened to the patient during their encounter at the CDO and is owned by the CDO (Garets and Davis, 2006). EMR is used interchangeably with Electronic Health Records (EHR), Computerized-based Patient Record (CPR) and Automated Health Records (AHR) but these are not the same. AHR comprises the scanned health document; CPR describes the individualized patient health information linked by a code and EHR is the longitudinal health records with entries by health care practitioners in multiple sites where care is provided (World Health Organization, 2006).

Recent publication in the health sector illustrates an increase in global interest in the use of EMRs and personal health records. For instance in 2013, the global market of EMR was estimated at $19.7 billion with a growth rate of 7.6 % in Asia Pacific; 6.6% in Africa, Europe

and Latin America; and 9.7% in North America (Accenture, 2010). The use of the EMR in either the developed or developing country is dependent on the service needs of the populace and health care constraints (WHO, 2006). In Canada, Europe and the United States of America, EMR is used to access, distribute and store patient information. This helps to improve quality of healthcare and enhance policy decisions (Hillestad et al., 2005; Williams and Boren, 2008). However, in Sub-Saharan Africa, EMR usage is sparse and slow due to resource constraints (Douglas et al., 2010). Ghana has over the years recognized the need for a reliable, effective and efficient health information system (Acheampong, 2012). This is reflective in the Ministry of Health (MOH), health sector Information Communication Technology (ICT) policy strategy that gives details of the planned implementation of health information technology. The Ghana Health Service (GHS), for instance collects its monthly routine data from health care facilities throughout the country by utilizing a nation wide web-based District Health Information System (DHIS) since 2008. GHS has over the years up-graded the DHIS to meet international standards by using the current DHIS-2 which is used by two hundred and ten (210) districts throughout the Ghana (Atweam, 2012). In addition, the submission of National Health Insurance Scheme (NHIS) claims is currently electronic. Furthermore, there has been some institutional trial of electronic health records at departmental levels such as the piloting of MedSpina (this a software that manages medical records, processes prescription writing, drugs database, practice management, statistical reports and financial accounting) at the diabetic center of Korle-Bu Teaching Hospital (KBTH). The KATH ED has over the years battled with the limitations of the paper based medical records. Therefore in 2012, the directorate piloted a hybrid EMR system. This is because the department could not afford the cost of running a fully electronic system.

1.2 Problem Statement

The legal records of patients generated electronically at hospitals and ambulatory environments constitute EMR. The benefits of EMR usage include: faster retrieval of patient files; avoidance of missing files; improved documentation and public health policy; decrease time spent on specific paper-based administrative task; improves quality of care and high level of satisfaction and promotion of convenient and efficient care (Marcus et al., 2009; Canadian Health Infoway, 2013). The main challenges with EMR use in both the developed and developing countries are financial constraints in implementing the programme, capacity building and opposition to the new technology (WHO, 2006).

The healthcare system in Canada until the inception of EMR had battled with human errors, client waiting times, management of chronic diseases, human resource capacity and care delivery outcomes (Nagle, 2008). In the United States of America (USA), EMRs have improved clinical decision making and documentation (Bercovitz et al., 2013). The paper based medical record system in developing countries is less efficient in meeting health care needs. Also, notable challenges such as communicable diseases, language diversity, lack of good communication platform, inadequate technology, funds, technical expertise and data processing facilities, natural disasters and security challenges have affected the availability and quality of health records in sub-Sahara Africa. In Ghana, universal access to health care is a priority. A number of policies have been enacted by the MOH over the years to improve health care delivery. However, the success of these policies is affected by inaccurate and untimely data reporting (Acheampong, 2012). Medical record keeping in Ghana is basically manual which presents challenges such as missing files; misfiling; need for more space and paper; delays in retrieving files and conflicts between records staff and patients. Therefore the use of an EMR system as an alternative appears more promising in mitigating these challenges.

The utilization of EMR in emergency medicine and trauma is rudimentary and unfriendly in Ghana. The KATH ED has over the years presented challenges of misfiling, missing files, long waiting times leading to poor patient satisfaction and delay in care process with manual records keeping. As a result, a pilot system has been introduced for emergency treatment to improve quality of care rendered to patients at the ED. However, no baseline study was conducted prior to the implementation of the pilot programme. Therefore, there is the need to conduct a process evaluation of the pilot EMR programme at ED for successful roll out of the programme at KATH and to provide lesson learning for health facilities with intent of implementing similar programmes.

1.3 Rationale of Study

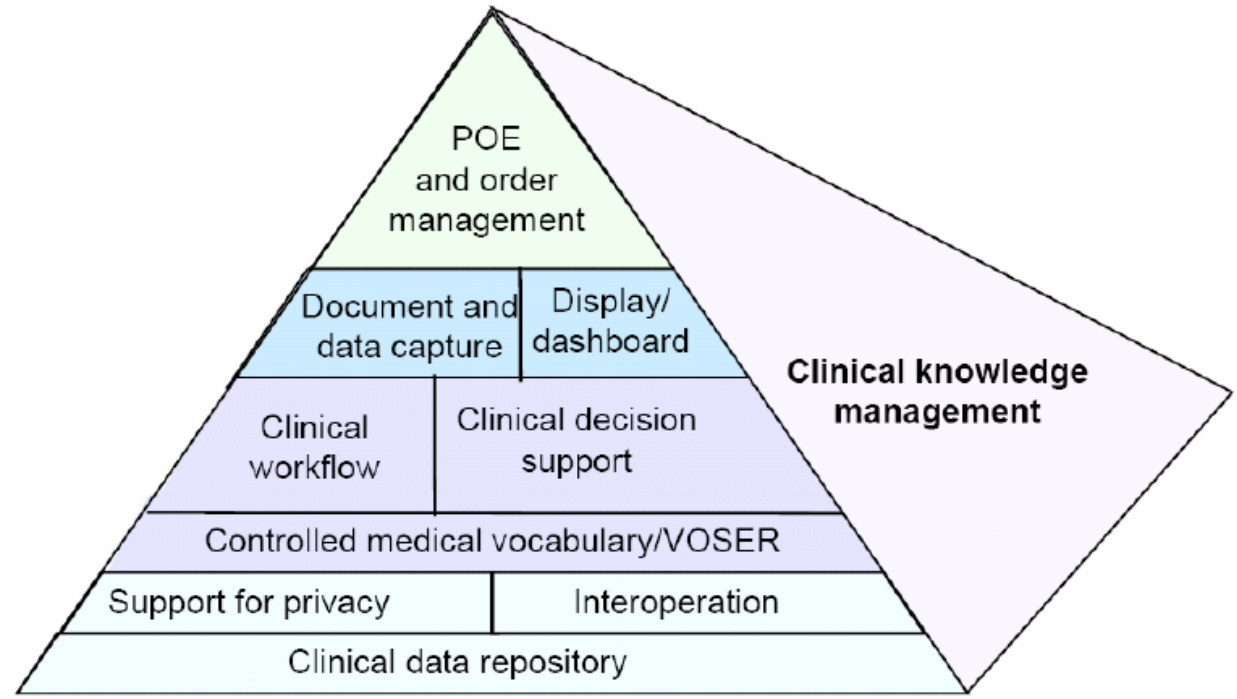
The pilot phase of the EMR at KATH has been ongoing since 2012. However, there is no formal documentation on the programme implementation. Therefore it is crucial that a study is conducted to critically assess the EMR at the ED. It is hoped that the results of this study will help improve healthcare in EDs through its recommendations. In addition, other EDs in the country and the sub- Region can learn from the EMR usage at KATH. Furthermore, it will equally inform policy makers in their decision making processes concerning emergency care. This will ultimately contribute to improving the efficiency and effectiveness of EMR use in EDs in Ghana through important lessons and up scaling.

1.4 Conceptual framework

The information from patients/clients within health care facilities is kept manually or electronically depending on the preference of the institutions following the patient's encounter with the facility. However, irrespective of the choice of medical record keeping, it is expected that efficient and effective services are provided for the patients/clients.

The figure below gives a diagrammatic representation of the core capabilities of EMR from the bottom up with the ultimate objective of improving workflow, reporting and outcome data, patient/provider satisfaction, bedside decisions, patient education, effective regulatory compliance, prompt error-free communication, continuity of care, competitive advantage, reimbursement, making it easier to achieve accreditation and ultimately reduce medication errors, malpractice premiums, morbidity and mortality.

The concept of a functional EMR system is composed of a clinical data repository, controlled medical vocabulary, clinical workflow, clinical decision support, clinical knowledge management, document and data capture, clinical knowledge management, physician order entry and order management. In addition, there is a display dashboard and the system is compatible with the institution's health care delivery. Moreover, adequate provision is made to promote data security.



VOSER: vocabulary server POE: physician order entry

Figure 1.1: Core capabilities of the electronic health records

Source: Adapted from Gartner Research (2004)

1.5 Research questions

1. What is the nature of EMR programme at KATH ED?

2. What have been the facilitators and barriers to implementing the EMR in KATH?

3. How can the above facilitators be implemented and barriers overcome?

1.6 General Objective

To evaluate the use of EMR in Komfo Anokye Teaching Hospital's ED.

1.7 Specific Objectives

1. To provide description of EMR progamme at KATH ED

2. To identify existing facilitators and perceived future facilitators to implementing EMR at KATH ED

3. To identify existing barriers and perceived future barriers to implementing EMR at KATH ED

4. To explore suggestions to implement facilitators and overcome barriers to EMR implementation at KATH ED.

1.8 Profile of Study Area

In the Ashanti region of Ghana, there is only one tertiary referral hospital, Komfo Anokye Teaching Hospital (KATH) which is the second largest hospital in Ghana. It is found in Kumasi, the regional capital with a total population of 2,035064 (Ghana Statistical Service Census 2010). KATH received all referrals from Ashanti, Brong Ahafo, Central, Western, Eastern, parts of Volta and Northern Regions of Ghana until the Tamale Regional Hospital was upgraded to Teaching Hospital hence handling referrals from Northern, Upper East and Western Regions of Ghana.

KATH popularly known as "Gee" was built in 1954 as the Kumasi Central Hospital but later named Komfo Anokye Hospital after Okomfo Anokye, a legendary fetish priest of the Ashantis. In 1975, it was converted into a Teaching Hospital and affiliated to School of Medical Sciences, Kwame Nkrumah University of Science and Technology (KNUST) Kumasi. The West African College of Surgeons has accredited KATH for postgraduate training in surgery, obstetrics and gynaecology, otorhinolaryngology and radiology.

The hospital has a thousand (1000) bed capacities with clinical as well as non-clinical directorates. The non-clinical directorates are security, domestic services and supply chain

management whereas the clinical directorate is composed of anaesthesia and intensive care unit; child health; dental, eye, ear and throat; diagnostics; medicine; obstetrics and gynaecology; oncology; polyclinic; pharmacy; surgery; accident and emergency department.

The study was conducted in the Accident and Emergency (A&E) Unit, thus the Emergency Department (ED) of KATH, Kumasi where the hybrid EMR is being piloted. The KATH ED has a 106 bed capacity, being the largest ED in the West African sub-region with modern state-of-the-art. It was commissioned in April, 2008 but became operational in May, 2008. The ED has the following units: triage, clinical decision, operating theatres, accident, consulting rooms, paediatric, burns, radiology, pharmacy, recovery wards, obstetric and gynaecological, laboratory, mortuary for overnight storage, administrative offices, central stores and materials management, central housekeeping and central staff changing area, plant room, and a helipad.

1.9 Scope of study

The study takes a critical look at the EMR implementation project at KATH's ED in terms of providing detailed description of the programme, current facilitators and barriers, perceived future facilitators and barriers as well as possible suggestions for implementing facilitators and overcoming barriers.

1.10 Organization of report

The report is sectioned into six chapters including references and appendices. The components under these chapters are: introduction, literature review, research methodology, results, discussion, conclusions and recommendations.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter reviews a wide range of literature pertinent to this thesis. These are grouped into three parts. The first part is on description of EMR programmes, followed by facilitators and barriers to EMR use and, lastly suggestions for implementing the facilitators and overcoming the barriers.

2.2 Description of EMR programmes

The use of the EMR was intended to eliminate the existence of the manual record keeping, meet the needs of health care providers and other stakeholders to maintain cardinal standards of care (WHO, 2006). The Health Insurance Portability and Accountability Act 1996 (HIPAA) privacy rule explicitly accords sole ownership and confidentiality rights to patients or clients irrespective of the nature of their health information (Federal Register, 2013).

The key users of EMR are nurses of varying categories, physicians and other clinical staff (Kamadjeu et al., 2005 and Dobrev et al., 2008). Miller and Sim mentioned documentation and care management, ordering, messaging, billing and patient directed practice as the constituents of the EMR (Miller and Sim, 2004).

The adoption of the EMR is either basic or comprehensive (Jha et al., 2009). It is also dependent upon patient demographics, clinical data views or investigation results such as radiology and laboratory, managers order entry and supports clinical decision (DesRoches et al., 2008).

However Dobrev et al (2008) reported of seven (7) stages of EMR adoption. Stage 0 has some clinical automation present but not all the three major ancillaries of pharmacy, laboratory and radiology are present. However, Stage 1 has all major ancillaries present to facilitate the

reviewing and retrieval of data. Stage 2 contains functional Clinical Data Repository (CDR), Controlled Medical Vocabulary (CMV), Clinical Decision Support/ Rules (CDSS) inference engine with document imaging present or not. Stage3 is composed of clinical documentation, CDSS for error checking and Picture Archive and Communication Systems (PACKS) in addition to radiology. In stage 4, Computerized Practitioner/Physician Order Entry (CPOE) and CDSS (clinical protocols) are present. The stage 5 in addition to the above has a closed loop medication administration whereas stage 6 has physician documentation (structured templates), full CDSS (variance and compliance) and full PACKS. Stage 7 is a fully functional EMR with CDO able to contribute to HER as a byproduct of EMR (Dobrev et al., 2008).

The study conducted by Hing and Hsiao (2010) in the United States of America among office based physicians observed that most EMRs were made to combine data from large ancillary services (pharmacy, laboratory, radiology, clinical component) dependent upon the data structure, features and components of the integrated system implemented by the technical team. Moreover, the administrative components had data on patients'/clients' registration, admission, discharge, transfer and vital information for patient identification that is inclusive of name, demographics, next of kin and a unique identifier. The unique patient identifier was used for all patient transaction within the CDO. The laboratory and pharmacy components were separate systems that were interfaced into the EMR (Hing and Hsiao, 2010).

Furthermore, the computerized physician order entry provides services for ordering, alerting and result reporting whereas the clinical documentation component gathers information on clinical notes, patient assessments and clinical reports such as peri-operative notes, discharge summaries, transcription document management, medical records abstracts, advance directives or living wills, durable powers of attorney for healthcare decisions, consents (procedural), medical

record/chart tracking, releases of information (including authorizations), staff credentialing/staff qualification and appointments documentation, chart deficiency tracking, utilization management and flow sheets (vital signs, input and output, problem lists,) by nurses, physicians and other clinicians. Additionally, the radiology services entailed image tracking, results reporting and patient tracking and scheduling which may or may not be integrated into the EMR system (Dobrev et al., 2008; Hing and Hsiao, 2010)

Recent research by Bercovitzet et al (2013) suggests that the most commonly utilized facilities of the EMR were patient demographics, clinical notes, clinical decision support systems, computerized physician order entry but electronic test reminders, review and external communication with other agencies are sparingly used.

Further research showed that there are eight capabilities of EMR,- order and system management, interoperability, data model, clinical decision support, clinical workflow, clinical documentation and data capture (for all clinicians), clinical display/dashboard(Gartner, 2012). The complete EMR system, in addition to the basic functions covers - emergency, Intensive Care Units (ICUs), operating theater, behavioural health, labour and delivery suites, home care and long-term care facilities (Gartner, 2012). Similarly Douglas et al (2010) in their study affirmed that EMR functionalities entailed clinical decision support systems, computerized physician order entry, consultant report, allergy alerts, nursing orders, patient problem lists, public health reporting, notifiable diseases sent electronically, viewing test results and electronic reminders for tests.

The Hsiao et al (2014) found out that the EMR features are recording of patient history and demographic information, patient problem lists, order prescriptions, warning for drug interaction

or contra-indications, prescriptions sent to pharmacy electronically, order laboratory tests, test orders sent electronically; view laboratory results, highlighted out-of-range values and imaging results; electronic images returned; orders for radiology tests; record clinical notes; medical history and follow-up notes; list of medications and provide guideline-based intervention or screening test reminders (Hsiao et al., 2014).

The study by Asabe et al (2013) in Nigeria suggested that irrespective of the particular type of EMR that was in use, the components included software (Window XP operating system, Microsoft access, Microsoft visual basic), hardware (System unit monitor [visual display unit (VDU)], uninterrupted power supply (UPS), Random Access Memory (RAM size of 64), Computer Disc (CD) Rom, hard disk capacity of 40GB and printer), programming language, database normalization and database implementation. The Microsoft visual basic MS, access 6.0 is the programming language used in designing the system with visual basic programming language environment made for the creation of other programs. The system design gives recognition to normalization, use of case diagrams and database design (Asabe et al., 2013).

Kalogriopoulos et al (2008) acknowledged the proprietary and open source software as the two main types of EMR software in their review of EMRs for developing countries. Also, the network system of choice was either Local Area Network (LAN) or Wide Area Network (WAN). Kenya, Rwanda, South Africa, Uganda, Tanzania, Zimbabwe, Lesotho, Malawi, Peru, and Haiti utilized open source medical records (Kalogriopoulos et al., 2008).

In addition, access control tools, audit trials and encryption were essential elements for data security purposes. Developing countries were encouraged to adopt the open source EMR as they were free and could be modified to meet user needs (Bagayoko et al., 2010).

The MEDCAB project in Cameroon was a locally designed EMR for primary healthcare practitioners that used International Classification for Primary Care (ICPC-2) disease classification and Visual Basic 6 (VB) programming language with Microsoft windows (MS-Access and MySQL) as databases for the system development platform. The user interfaces included administrative, medical encounters, patient registration, appointment management, report generation and diagnosis (Williams and Boren, 2008).

The study by Douglas et al (2010) in the Malawian Antiretroviral Treatment (ART) Clinic EMR designed a flexible system that supported workflow in which touch screen computers, thermal label printer and barcode printer were the hardware used. The barcode on the patient's health passport was scanned and logged in before services could be provided. The EMR system was equipped with adequate security for patient data; health workers had limited access to patient's past history; facilities for clinical calculation and prescriptions; standardized questions for patient to answer; automated reports for monitoring and evaluation were also present (Douglas et al., 2010).

Fraser et al (2005) also reported on a number of EMR projects in some developing countries. These included the Mosoriot Medical Record System (MMRS) that was developed in 2001 to serve 60,000 patients. It ran on Microsoft Access and on two networked computers that were powered by UPS and backed up with a solar battery. Patients were readily registered unto the system on their arrival to the clinic and presented only paper visit forms at other units of the facility for services. Fraser et al (2005) also made mention of Partners in Health (PIH) open source web system in Peru which was backed by an Oracle database where 4300 patients benefited from this system in 1996. Moreover, in 1999 PIH provided another EMR system in the rural parts of Hati. The system had an added offline function for 4000 users. Furthermore, the

Careware EMR system in Uganda that was a stand-alone database built with Microsoft Access and Malawi housed an EMR system where there was a touch screen patient management information system (Fraser et al., 2005).

2.3 Facilitators of EMR

EMR facilitators are activities or initiatives under taken by institutions or the government to promote implementation and usage of EMR (Cotea, 2010). EMR facilitators varied among the user groups - physicians, professionals, managers and patients (Kamadjeu et al., 2005 and Dobrev et al., 2008).

In reviewing the impact of EMR on physicians' practice in Canada, Lau et al (2012) observed three main levels of EMR facilitators - micro-, meso- and macro or health care standards. This was further supported by a similar EMR study conducted among occupational medicine physicians in Romania (Triff et al., 2012). The micro-level facilitators were system quality factors, information quality, service quality and EMR usage factors (Lau et al., 2012). However, people factors, role responsibilities, organizational factors and implementation factors constituted the meso-level facilitators whereas the health care standards were standardized data content, legal documentation that affected EMR documentation, performance and user behaviours, practice standards for clinical guidance, professional scope of practice and medico-legal requirements that govern EMR use and funding / incentives (Lau et al., 2012 and Triff et al., 2012).

Other facilitators identified among the different user groups included perceived ease of use, motivation, productivity and familiarity (McGinn et al., 2011; Achampong, 2014)

Additionally workflow impact, technical support through personal contacts or documents, interoperability, communication (thoughts, opinions or information by speech or writing), or expert support where a physician had knowledge to help another physician accomplish a medical task via document or personal contact or a physician with experience in electronic health record usage assisted with information about how to use the system have been documented as facilitators (McLean, 2006; Castilo et al., 2010 and McGinn et al., 20ll).

Also, Nagle and Catford's (2008) study mentioned prioritizing investment in information management tools, clinical information system, electronic health records education and training, process and work integration, 24-hour user assisted support clinical processes and applications, evaluation and EMR education curriculum as crucial in adopting EMR (Nagle and Catford, 2008).

According to Hillestad et al (2005), institutions analyzed the cost-benefit of EMR use over the manual records keeping before usage. Also, most institutions would opt for EMR if they are assured of government incentives such as global economic recovery and networking of health systems at both the regional and national levels. For instance, the USA had the American Recovery and Reinvestment Act of 2009 (ARRA) that provided $36.5 billion to promote EMR whereas $450 million was voted for e-health in Australia (Accenture, 2010). Moreover, different sources of incentives were crucial for EMR adoption (Hing and Hsaio, 2010). Thus, affirming previous findings of the critical role of financial incentives in EMR adoption (DesRoches et al., 2008).

Additionally, objective third-party evaluations of the EMR products, availability of support for the implementation of information technology and reimbursement for EMR utilization have been

noted as facilitators (Jha et. al., 2009). Moreover Triff et al (2012) research found that, where the use of EMR was a by-product of sponsored projects, its adoption was successful. Also, the knowledge of EMR terminologies was essential for EMR use (Triff et al., 2012). This is buttressed by Douglas' study where EMR was used in conducting chronic diseases clinics such as the Malawi ART Clinic (Douglas et al., 2010). Active involvement of facility heads/management, availability of computers, and existence of prior and strong data collection culture also promoted EMR adoption in Cameroon (Kamadjeu et al., 2005).

Further findings by Saleem et al (2005) reported that the limitation of the number of reminders at a site; strategic location of the computer workstations; integration of reminders into workflow; the ability to document system problems and receive prompt administrator feedback were additional EMR facilitators. Moreover, learning, workshops, infrastructure, T-shaped skills, non-formalization, mutual trust, non-centralization and collaboration were identified as enhancers of EMR utilization (Hmis, 2008; Gururajan and Hafeez-Baig, 2014).

Recent studies made mention of error reduction, clinical and administrative efficiency, health outcomes, project planning, user perceptions, good security infrastructure and privacy settings, facility characteristics and time saving as promoters of EMR use (Achampong, 2014; Healy and Lubeck 2012; Kruse et al., 2015).

Finally, the engagement of all stakeholders and standardization are cardinal in the selection of particular types of EMR systems to adopt (African regional ministerial meeting, 2009; Cotea, 2010; Canada Health Infoway, 2013).

2.4 Barriers of EMR

Cotea (2010) defined EMR barriers as the perceived personal (professional and psychosocial determinants that influenced individual stakeholders attitudes towards EMR use) or organizational (financial and technical factors that affected the stakeholders' implementation of EMR) constraints or challenges mitigating the effective and efficient use of EMR.

These barriers include high initial financial cost; slow and uncertain financial payoff; high initial physician time costs; difficulties with technology, complementary changes and support; lack of financial incentives; inadequate electronic data exchange; physicians attitude; difficult complementary changes and inadequate support (Miller and Sim, 2004; Kleynhans, 2011; Ajami and Baghexri-Tadi, 2013). Additionally, Hersh (1995) and Triff's et al (2012) identified absence of legislation; increase workload; lack of communication standards to ensure interoperability with other similar applications; need for changes in work activity as barriers of EMR (Hersh, 1995 and Triff et al., 2012).

Moreover, in reviewing literature on critical factors for the adopting EMRs, lack of coordination among end users was noted as a constraint (Castillo, Martínez-García, and Pulido, 2010).

Furthermore, the flexibility of information technology investments; product innovation; tailored processes and customizability were recognized as barriers to EMR usage in Canada (Canada Health Infoway, 2013).

Other EMR studies conducted by WHO (2006), Ajami and Bagheri-Tadi (2010), and Akanbi et al (2012) in Iran, Sub-Saharan Africa and other developing countries reported of clinical data entry issues; lack of standard terminology; resistance to computer technology; strong resistance to change by many healthcare providers; concern by providers as to whether information will be

available on request; concerns raised by healthcare professionals, patients and the general community about the quality and accuracy of electronically generated information; lack of staff with adequate knowledge of disease classification systems; amount and quality of space needed for computers as obstacles to EMR use. Similarly, recent research by Zandieh et al (2014) reported of limited office space for storing computers used in running the EMR programme (Zandieh et al., 2014).

Moreover, challenges with information gathering and role ambiguity were identified as obstacles to EMR usage (McGinn et al., 2011), and missing test results and difficulties in interpreting test results as additional EMR challenges (Hysong et al., 2011).

Whiles studying about EMR barriers in USA, Linder et al (2008) observed that users of EMR were besotted with challenges such as loss of eye contact with patient, falling behind schedule, computers being too slow, inability to type quickly enough, feeling that using the computer in front of the patient is rude, and preferring to write long prose notes, computers "timing out", a lack of fast printers, pop-up blocking software that interfere with the EMR, lack of computers in some examination rooms, screen navigation not being able to access other functionality while writing a notes, loss of data, a desire "to concentrate separately on patients' needs and 'needs of documentation. There were instance that inadequate printers were used to run EMR system (Zandieh et al., 2014). In addition, EMRs were said to be less supportive of clinicians and their settings (O'Mally et al., 2009).

Miller and Sim reported of inadequate support systems and difficulty in complementing changes as barriers to EMR usage (Miller and Sim, 2004). All end users who were not familiar with Information Technology (IT) use were not eligible to operate the EMR (Hersh, 1995 and Gagnon

et al., 2014). Moreover, the lack of Health Information Technology for Economic and Clinical Health (HITECH) was a focal barrier of EMR adoption (Kruse, 2015).

Other limiting factors to EMR use were back loading of legal data, redundancy, lack of evaluation and monitoring coding/billing, lack of feedback on EMR training, alerts and reminders (Bornstein, 2012). Also the shortage of clinical IT specialists was a challenge (Williams and Boren, 2008; Accenture, 2010 and Douglas et al., 2010).

Whiles studying about EMR adoption in Europe, Iran and developing countries, the lack of guarantees of privacy and confidentiality; lack of equal access to the internet and lack of clarity of expectations were noted as barriers to EMR use (Williams and Boren, 2008; Ajami and Bagheri-Tadi, 2013; Passarani, 2013).

Navigation difficulties, EMR's perceived disadvantages, incompatibility with practice, and intrusion in examining room limited EMR adoption (Ilie, Courtney and Slyke 2007). Also, Lober et al (2008) and Holden (2011) enumerated absence of electricity and wireless connectivity as other barriers to use EMR.

The uncertainty about return on EMR investment, too many data sources and concerns that the system will become obsolete have been realized as added bottlenecks of EMR adoption (Hersh, 1995; DesRoches et al., 2008; Williams and Boren, 2008; and Jha et al., 2009).

Boulus (2005) and Kleynhans (2011) reported of the transitory phase challenges faced by users of EMR such as disruption of work schedules, temporary decrease in productivity and the concurrent use of both electronic and manual records. Additionally, Logue and Effken (2012) research found that stakeholders with low health literacy, high computer anxieties; physical and cognitive impairment could not adopt EMR systems. Moreover, the occasional changes in staff

that resulted in some leaving the facility or practice or the management position and the loss of computers resulted in low EMR adoption (Kamadjeu et al., 2005).

In Australia, it was observed that patient education was a barrier to using the EMR system (Gururajan and Hafeez-Baig, 2014). Some recent studies also made mention of challenges with date and language as other barriers of EMR use (Bagayoko et al., 2010; Bouamrane and Mair 2013; Chaudry and Koehler, 2013). Further studies observed that EMR utilization was constrained by low performance on goals dependent on health information technology and data limitation in meeting research requirements (Malaekeh et al., 2012; Newgard et al., 2012 and Jha et al., 2009).

In Ghana, poor maintenance culture, lack of policy to spearhead implementation of EMR and lack of flexible systems as in the case of Korle- Bu Teaching Hospital have been identified as barriers to EMR use (Lubeck and Healy, 2012; Achampong, 2012).

2.5 Suggestions to implement facilitators and overcome barriers

The adoption of EMR by health care providers should ideally be preceded by comprehensive environmental scanning (WHO, 2006). This section provides some suggestions based on findings from previous EMR research towards successful implementation of EMR.

Some studies suggested the need to develop policy strategies to focus on financial support, training of technical support staff on EMR, interoperability, adaptability and flexibility of EMR usage (Jha et al., 2009; Robertson et al., 2010 and Mair et al., 2012). Similarly, O'Malley et al (2009) found that there was the need to expand the review of policies to encompass care coordination to promote inter practice data exchange and multi provider decision support as well

as, focusing on the establishment of policy reforms that will facilitate EMR implementation in healthcare settings.

Recently, Bouamrane and Mair (2013) study in Scotland concerning general practitioners' perspectives on EMR, observed that stakeholders of EMR had to become familiar with EMR vendors and promote the culture of user-centered improvement in order to overcome EMR challenges and increase its utility (Bouamrane and Mair, 2013). Furthermore, pragmatic efforts were to be instituted to harness patient's data security and privacy in health care setting that used EMR (Achampong, 2012). Moreover, consideration had to be given to strong leadership and project management techniques; personalized effective training and education; and creation of EMR usage standards (Cotea, 2010 and Canada Health Infoway, 2013).

In the study of EMRs in developing nations, Kalogriopouos et al (2008) reported that it will be worthwhile if developed nations could support developing countries to design and implement EMR that fit into their environment. In addition, further research, evaluation and development were recommended in the EMR fields (Kalogriopouos et al., 2008).

The future of EMR will be much enhanced if healthcare providers built and nurtured trust in their relationships with colleagues. Even in competitive environments, staffs are encouraged to prioritize organizational interests above personal goals (McCarthy et al., 2014).

According to the recent research by Gururajan and Hafeez-Baig (2014), EMRs should be treated as public goods. Also, healthcare institutions had to establish some regulations and incentives for EMR adoption (Gururajan and Hafeez-Baig 2014). Apparently, there was the need to provide work practice support systems to improve electronic data exchange (Miller and Sim, 2004)

The success stories of EMR programmes required the involvement of all categories of leadership with the political will at the institutional and national levels to implement and maintain the EMR system. Also, EMR stakeholders are expected to take lessons from the in-depth experiences of previous users and make inputs in the design, implementation and maintenance phases of EMR. Local debates could be organized on EMR to solicit public views (Hmis, 2008; Williams and Boren 2008; Robertson et al., 2010; Mair et al., 2012).

Rozenblum et al (2011) suggested the creation of chief provincial clinical information office to develop the criteria for utilizing useful EMR data. Clinicians are encouraged to invest in EMR use (Rozenblum et al., 2011). EMR users are encouraged to meet regularly and have longer discussions on IT issues to promote EMR utilization by sharing and exchanging knowledge and experiences. Typing courses are recommended for doctors (Boulus, 2005).

Finally, Hysong et al (2011) in their study mentioned the need to improve contents of the alert system and bundle related alerts to avoid overlap and redundancy whiles utilizing the EMR system.

CHAPTER 3

3.0 METHODOLOGY

3.1 Introduction

The chapter entails the study methods and study design; data collection techniques and tools; sampling; pre-testing; data handling and management; data analysis and ethical consideration.

3.2 Study Methods and Design

This is a non-interventional descriptive cross-sectional study that employed the qualitative approach of research. Descriptive cross-sectional study allows the collection of data from participants at a single point in time on the frequency and distribution of health-related exposures or outcomes in a defined population (Bailey et al., 2006). This study design was employed because it was relatively simple to conduct, required less time and no follow-up on study subjects. Therefore the design was appropriate for this study since the time frame allocated for the study was too short. The study was conducted from July to August, 2015.

3.3 Data Collection Techniques and Tools

The study was a qualitative study where semi structured interview guides developed by the researcher as attached in Appendix 2 were utilized in data collection. This allowed the interviewer or interviewee to elaborate on unanticipated and potentially valuable information with additional questions, and probe for further explanation. The consent of all the interviewees was sought and copies of the information sheet were given to each participant. The data were collected at the ED of KATH by the researcher in English language which was well understood by all interviewees for duration not exceeding 45 minutes per section. The interviews were manually recorded. The types of data collected included description of the EMR programme at the ED, facilitators and barriers on EMR use at the KATH ED as well as suggestions to

overcome those barriers and for successful implementation of the programme facilitators at the KATH ED.

3.4 Study Population

The study population for the survey was all core implementers and end users of the KATH ED EMR. The core implementers were the four main persons whose collective efforts brought about the implementation of the KATH ED EMR pilot project. All the KATH ED medical records staff, triage nurses and National Service Personnel (NSP) stationed at the Emergency Medicine Information Technology (EM IT) /Research Office constituted the end users.

Inclusion criteria

1. All core implementers of KATH ED EMR programme and end users were interviewed

Exclusion criteria

1. All implementers and end users of Hospital Administration Management Services (HAMS), another form of EMR which was used for administrative purposes within KATH but not in the ED.

3.5 Sampling size and sampling method

3.5.1 Sampling size

All core implementers and end users of KATH ED EMR were interviewed. A total of four (4) core implementers and twenty (20) end users of the KATH ED EMR were interviewed.

3.5.2 Sampling techniques

The participants for the study were purposively chosen by selecting and interviewing only the core EMR implementers and end users at the KATH ED. All interviewees (core EMR

implementers and end users at the ED) were contacted through phone calls and scheduled at their convenience for a face-to-face interaction.

3.6 Pre-testing

A small scale trial of the study was conducted by the investigator at the Dental Unit of Korle-Bu Teaching Hospital (KBTH), Accra - Ghana where two (2) core implementers and five (5) end users' of EMR were interviewed. The outcome of the pre-testing informed the investigator about the feasibility of the study and changes which needed to be effected. Subsequently, corrections were made with regards to questions that were ambiguous before the final interview guides were printed.

3.7 Data Handling

The data was subjected to quality control checks. The investigator adhered to good data practice and maintained the confidentiality of the interviewees. Therefore, hard copies of data have been kept under lock and key accessible to only the investigator for a period of five (5) years and soft copies kept on investigator's personal computer with backups on external hard drive and drop box mail under security code known only to the investigator.

3.8 Data Analysis

The field notes were transcribed into fair notes which were then analyzed thematically facilitated by manual analysis. Initial codes were applied to the transcripts; these were then refined and sorted into potential themes. Subsequently, they were grouped into major categorical headings which were mapped on to the questions asked. The major categorical headings were detailed description of the programme; facilitators and barriers of EMR usage at KATH and suggestions to implement facilitators and to overcome barriers to EMR implementation at KATH ED.

3.9 Ethical Consideration

The investigator applied for ethical clearance from the Committee on Human Research Publication and Ethics, Kwame Nkrumah University of Science and Technology and Komfo Anokye Teaching Hospital, Kumasi after securing an approval from the KATH ED Head of Directorate to conduct the research. The approval for the study was given in July, 2015.

Also the interviews were conducted on individual basis to uphold confidentiality and anonymity of interviewees. A verbal consent and voluntary participation were sought from participants by using the information sheets.

3.10 Limitation of study

The main limitation of this study was that there was no EMR evaluation tool in place at the KATH ED. Also, there was no baseline data on the ED's EMR for assessment and referencing. Moreover, the respondents objected to audio recording of the interview even though the interviewer put in place adequate measures to promote confidentiality.

3.11 Assumptions

It was assumed that, the different categories of respondents who participated in the research shared some similarities in their various field of practice, had utilized the hybrid EMR at the ED and provided accurate and authentic responses to the best of their knowledge.

CHAPTER 4

4.0 RESULTS

4.1 Introduction

This chapter covers the qualitative analysis of participants responses from the interview conducted on twenty-four (24) end users and core implementers of the KATH ED EMR.

4.2 Description of the EMR programme

4.2.1 Back ground of the EMR at KATH ED

KATH ED EMR was piloted in 2012 by the internal management of the accident and emergency department, spearheaded by the Head of Department (HOD) with the support of two dedicated emergency medicine physicians aided by a professional computer software programmer/developer. It was a hybrid EMR system, thus manual records of patients were documented alongside the electronic data input which were done at the front desk and the triage areas by medical records staff and nurses respectively. The system was basically for documentation and not comprehensive. Thus, the clinical interphase that was piloted for one week was no longer functional. All patients' folders were scanned after accessing care at the EM IT/Research Office.

The aim for establishing the KATH EMR was to improve emergency care through data persistency and up scaling to other EDs in the sub-Region. In addition, it was intended to merge data from ED's EMR unto the HAMS which is another form of EMR in use at KATH for administrative purposes

4.2.2 Personnel

The data entries were done by five (5) medical records staff at the front desk and eleven (11) nurses at the triage area. However, patients' folders were scanned by four (4) NSP stationed at the EM IT/Research Office. There were four (4) core implementers; the HOD, two (2) emergency medicine physicians and one (1) computer software programmer/developer whose services was outsourced as and when needed.

4.2.3 Components of the EMR (network, server, software and hardware)

An open source medical records was freely downloaded and customized to meet needs of the ED. The network was local area network/wireless local area network (LAN/WLAN). The server was HP I7 desktop and located in the EM IT/Research Office. The database server used was MySQL Structured Query Language. The web server used was APACHE. The ED's hybrid EMR web pages were constructed using Hypertext Markup Language (HTML), with dynamic elements implemented using PHP and JavaScript programming languages, as well as Cascading Style Sheets (CSS). The operating system of the server was Linux (Ubuntu). However some of the computers accessing the EMR used Windows as the operating system on desktops and laptops as well as Ubuntu desktops and mobile devices (tablets). There were ten (10) desktop computers and two (2) tablets which were all connected to routers. There was a computer each located at the triage and front desk for EMR purposes and the rest were kept in the EM IT/Research Office. The Random Access Memories (RAM) was within the ranges of 512MB-4GB; hard disc 40GB-3TB; processor speed of 1GHz-16GHz and the system unit were the tower type. It has two scanners but only one was operational.

4.2.4 Data entry and management

Data management involved basically the bio-data of the patient which entailed patient's demographics and encounters. Patient's demographic information recorded included the name, age, date of birth (DOB), sex, date, hometown, marital status, occupation, hospital identification number, district/municipal/metropolitan area, religion, region, home address, insurance scheme, next of kin, home telephone number, cellphone number, nationality, electronic mail address, mode of arrival to facility (whether by national or private ambulance, taxi, private car, walk-in, wheeled in, "trotro" or police van), referred or not, date and time of registration were automatically picked up by the system and keyed into the system at the reception by the medical records staff. The category of visit was classified as established or new patient, office visit or reserved.

Patient encounters were categorized as either new or past encounter. On the encounter form, a brief description of consultation , category of visit, facility, billing facility, sensitivity, mode of arrival, referral status, referral source, date of arrival, onset/hospital date, issues (allergies/medical/injuries) were captured.

Subsequently, the patient's name was registered unto a white board at the front desk. The white board contained the list of all patients who were yet to be triaged. The patient's name was deleted from the white board when he arrived at the Triage Unit.

At the Triage Unit, the registered name was accessed from the EMR database and other details added. These were date and time; chief complaint; weight (kilograms), Random Blood Sugar (RBS) level (mmol/l); oxygen saturation level; mobility - walking, with help, stretcher, immobile, old stretcher, with help (old); respiratory and heart rates; systolic and diastolic blood pressure (mmHg); temperature (degree Celsius); Alert, Voice, Pain, Unresponsive (AVPU);

trauma – yes/no; Total Early Warning Signs (TEWS); initial and final triage colours - red, orange, yellow or blue; discriminator (applicable when for any reason the assigned triage colour according to TEWS needs to be changed) and any additional notes. The triage form was then printed out in colour or black and white. A coloured sticker was attached to all black and white print outs. For the old registrant, the hospital number was keyed in and a new encounter was generated.

End users had individualized password and limited privileges on the hybrid EMR platform. The patient's data was saved on a secured database server which was accessible to only two people who had user names and password to access it. The systems backup was manual and it had to be done on a daily basis. There was no data transferring or sharing, and the KATH ED EMR team had reserved rights to data fully. Data backups were kept on CDs.

4.2.5 Funding

The KATH ED Hybrid EMR was not a funded project. However, various forms of support have been received from the ED's HOD, one of the grants of Kwame Nkrumah University of Science and Technology (KNUST)/Medical Education Partnership Initiative, some American physician associates of the HOD and ED's internally generated funds.

4.3 Facilitators of EMR

4.3.1 Existing facilitators

The themes identified are; logistics, capacity building and trainings, human resource and motivation.

Logistics

Most of the respondents mentioned the readily availability of computers (desktops and tablets), scanners, storage devices and printer to run the EMR:

There are readily available items to use (interviewee 15)

Availability of electronic machines like palm top, laptop, printer and storage devices (interviewee 1)

Moreover there is a scanner which also helps in keeping records. Currently, the department has new version of computers (interviewee 18)

All the computers for the project were linked to the server. Thus intra-net system was used for running the EMR in all the Units:

The system works on an intra-net basis and all the systems are linked to the server. There is no internet facility for all the staff, otherwise they will lazy about and will not work but be doing their social network stuff. The internet available is limited and one requires a password to access it (Interviewee 20)

I think that there is no wireless, expect for the local area network (Interviewee 1)

This system among other things ensured that each patient was registered once:

Also, helping us to solve double registration of patient because system didn't allow you to register same patient twice (Interviewee 22)

Helps with duplication of record, no multiple identification (ID) is used for patient's registration. Contrary to what other believe, system method for registration, say pay provides full proof accurate records because records bring folder numbers missed (Interviewee 23)

Capacity building and trainings

Most of the participants had some form of Information Technology (IT) knowledge which made it easier for them to use the EMR:

> *With the skills acquired in IT it made it quite easy to use the system. The system was good but difficult to use it when the patients are more than one (Interviewee 6)*

> *My own knowledge about ICT because I have attended ICT school before (Interviewee 12)*

> *The basic IT knowledge I had from school coupled with what I had gained from colleagues improved my utility of the system (Interviewee 13)*

However, all end users were trained on how to use the EMR system before the implementation of the programme:

> We *were given an orientation on how to carry out everything (Interviewee 13)*

> *An informal training of some sort was done for us but one had to have basic IT knowledge before he or she could access the system (Interviewee 11)*

> *IT people do training, training on HAMS not on EMR but just go through about one (1) hour on how to use the EMR (Interviewee 8)*

This made it easy for them to use the EMR (see first and second quote) and to manually back up the system daily as stated in the third quote:

> *I didn't face any difficulties using it (Interviewee 13)*

We use open EMR and platform built on were free. We needed to customize it. Just like when you are preparing palm nut soup, we had to buy the ingredients to prepare the soup, unlike ready-made palm nut soup (Interviewee 24)

The data is constantly back up by medical records staff and the hospital's IT staff (Interviewee 11)

Human resource

The ED's internal management fully supported the project and the HOD was the focal contact person:

The instruction to use the system comes directly from the head. Therefore people are obliged to use it (Interviewee 20)

It is the management decision for us to use the system (Interviewee 7)

Support from management. Management ensured that the system was working and there is involvement of department management (Interviewee 1)

There were readily available trained personnel to resolve challenges encountered in utilizing the system:

There was readily availability of personnel, primarily the implementers of the EMR programme to resolve problems (Interviewee 12)

There are personnel who have knowledge in IT to help run the EMR system in the hospital (Interviewee 17)

People serving the machines and personnel trained to manage the system are around (Interviewee 1)

The core implementers of the project in addition to their clinical schedules did facilitative supervision of the end users, especially when there were new staffs:

The supervision from the leaders has really helped us to get along successfully (Interviewee 10)

There is strong supervision from the superiors which kept us on our toes to do the right things and work towards meeting timelines (Interviewee 19)

The various end users and the core implementers had good working relationships. This has therefore promoted coordination in running the system:

There is coordination between the biostatistics department and the information management team. This enhances the flow of information (Interviewee 1)

Motivation

The core implementers and end users of the project were not given any remuneration for their role in the project. However, they were intrinsically motivated to see to the full implementation of the EMR system to support emergency care:

It is self-motivating because it is so disheartening to see the patient that you care for lose all his medical records. Therefore the ED's EMR will promote emergency medicine care (Interviewee 22)

Also, the system promoted data persistency and easy access to patients' data:

Searching for patient's folders is easy because present condition might be related to history (Interviewee 15)

Staff present realize that there were some benefit. Example, an elderly man who is a known diabetic and hypertensive came in and his fat folder was lost but we were able to print out for him the entire folder from the scanned files. This got the records office much involved in the EMR (Interviewee 21)

Importance we realize we will get from it like easy access to data at any point in time that we wanted it. Easy access to soft records (Interviewee 22)

Furthermore, the system supported family members to easily locate the whereabouts of their relatives on admission:

Their reason been that computes will make it easier for relatives to locate their patients. When you check, it will make it easier for relatives to locate their patients (Interviewee 7)

To keep information about patient (Interviewee 8)

Additionally, the system is user friendly which can easily be merged with systems like HAMS which is currently being used in other departments of KATH:

We want to be ready when HAMS is ready. The hospital has HAMS since three (3) years now. ED collect its own data, regulates data to HAMS when it is being implemented. Data table, data base field names are the same as what HAMS has, example demographics. Once HAMS is installed, literally ED EMR data can be copied there. We have had series of meetings with HAMS team. Their words are not 100% reliable.

Therefore, this gives one reason to ploy on open EMR. Tried to simulate HAMS platform (Interviewee 24)

Also, the users were enthused with the benefit of the EMR (see first quote) and general commitment of the users cannot be underestimated (see second quote):

The old ways of was writing thought writing was so much. Computer system will make it simple, faster and easy (Interview 7)

Dedication of team of personnel, in fact, they have been good. Each day there is so much to do yet we willingly do it because our supervisors want the best for their clients (Interviewer 10)

Lastly, the EMR makes staff internationally competitive (see first quote) and improved quality care (see second quote):

The fact that it is in universal database, the fact that if we needed to send data that really helps, it puts you on the cutting edge of medical technology, knowing that what you are doing is what other countries are doing (Interviewee 23)

A lot of data can be grouped to help implement advocacy and competency. The system has the ability to query database and get report done. Example what times people are reporting most. For instance, when you want staff to be here when patients are attending say 11am – 3pm. This is where you want to direct most of your staff without cost or threats. Age, gender, what diagnosis example if you keep x-rays, if you keep x-rays, issues of QA to set up as we go up. Someone goes with patient in when they arrived, process, sign post, presenting complains. Say for many people triaged in yellow are

dying, transfer treatment to those small group of people. When there is overcrowding. All these are reasons to implement EMR. We hope that we can improve on quality of care. (Interviewee 24)

4.3.2 Perceived future facilitators

The themes considered are; human resource, training, motivation and logistics.

Human resource

The users suggested employing skilled IT personnel to enter data for triage nurses instead of the nurses entering data alongside provision of care:

Assign people to do entry because combining with nursing activities can interruption because if you are attending to patient and at the same time you are doing entry some of the information will slip off (Interviewee 1)

Yes if we have somebody solely for entering instead of triage nurses entering. Those who do the entries if they backup the system it will help because sometimes you will triage out five (5) patients and records has not even entered the system (Interviewee 7)

Also, engagement of 24 hour IT personnel would be useful to handle all emerging IT problems or emergencies promptly:

Rotation if the put here are about size. There should be a shift system where people come in with fresh energy to work (Interviewee 10)

There should be existing IT personnel at night to resolve EMR problems (Interviewee 20)

The complete involvement of KATH management would be vital for the success of the project:

The cooperation and coordination of hospital management is required so that it will not delay but make the work fast (Interviewee 1)

We need the support of the hospital's management for them to actually see that this is needful for us to adapt to current system (Interviewee 21)

Training

Regular in-service training for old and new staff at the ED would be useful to sustain users' interest and efficient use of the system:

Remedial or continuous training sessions so people are reminded of all data fields we want to capture, repeat training episodes. They need to be funded; training has cost (Interviewee 24)

Educate people more on it so that they can embrace the system because eventually, the folders wipe off and the older system of keeping records where folders are missing will be stopped (Interviewee 10)

The training for the medical records staff should include skills to be able to generate unique identifiers for patients who are to be registered unto the EMR data platform:

Additional information like unique ID to bring all information about patient is important. This must be addressed in the coming years (Interviewee 16)

Also, the training should include how to use manual records alongside the EMR as an emergency plan to ensure work continuity in case the EMR system break down:

Provide additional book for other things, especially when the system is not functioning, and all other things that aren't captured by EMR but may be needful (Interviewee15)

Motivation

The staff suggested that some form of reward should be given to them to compensate for the additional work:

This EMR stuff is good but there is so much to do. It's not an easy task pulling folders apart and scanning. Then afterwards you have to put everything back. I think some form of motivation, whatever the form will help. Be it word of mouth, any other thing (Interviewee 10)

However, the motivation of the core implementers of the programme was to fully develop KATH's ED EMR and subsequently extend such facility to other EDs in the country to positively impact on emergency care:

My main motivation of this whole project has been to see the patient l cared for come back to have his document intact (Interviewee 21)

Extend connectivity to other wards and unit to improve care (Interviewee 8)

To still use the system, the motivating factor has not changed. We want it to be a nationwide programme. We want to, we should be able to see what you were seen in Wa for and in Kumasi. The motivation is to finish developing KATH's one and then spread it out to all hospitals. Data is secured and you can access in other hospitals. That is "one folder per Ghanaian". This will all prevent adverse reaction to medication (Interviewee 23)

Additionally, the core implementers expect staff to generate clinical reports from the EMR database and refer to the system for specific case management:

> *If it is able to generate data for us, if we can get report we are doing it we are still generating reports manually (Interviewee 22)*

> *Scanning records preventing data from being lost, in future, selected bits can be in put electronically and one can quickly retrieve these data. Say, for diabetic ketone acidosis (DKM) and retrieve for their management thereof. We acquired scanners, from the database cubicle, notes are detached and scanned. We have over one hundred and thirty thousand (130, 000) folders since 2010 to scan, of these 3-4% has been scanned. Ideally we are hoping to get to the stage where patients' folders will be scanned the same day they are seen by a doctor (Interviewee 24)*

Also, some respondents were optimistic that with a well-functioning EMR, access to clients' records will be improved to promote emergency delivery services:

> *A better flow of access to the folders; say, at each point in time one can determine where the folder is (Interviewee 10)*

> *The difficulty of patient leaving notes in pharmacy or laboratory will be over. Patient comes in, paper records goes to those departments like x-ray or pharmacy. By scanning paper records, no such loss will occur. When we get to the phase where we are able to concurrently scan patient files whiles he is accessing care, then those ancillary departments that help the emergency to function can look at those records online (Interviewee 24)*

Furthermore, the ability of practitioners to retrieve laboratory results electronically (see the first quote) and stored electronic data as a source of secondary data for various clinical and quality assurance (QA) researches in the future (see second quote) were also mentioned:

> *If they see the benefit or the returns on the initial usage of the EMR, say doctors are able to get their laboratory results online instead of sending over people (Interviewee 20)*

> *QA research, this is very important. Hopefully, in the future pertinent records on patients like preferred pain relief, whether a known asthmatic, people who are fitting, did they all have glucose test done? Get information at finger tips (Interviewee 24)*

The thought of using solely EMR in the future for all service delivery at the ED (see the first quote) and the ability of the ED's hybrid EMR to provide online services and information needed for clinical care (see second quote) were also mentioned:

> *In the future they should not use the outpatient department (OPD) card system. It should be fully electronic with persons doing the keying in situated in all the wards (Interviewee 3)*

> *Provision of online services such as telephone directories, contact details of staff routers, teaching materials, didactic teaching material, bulletin board, information cascade use for giving information like bed states - there are beds but people say there are no beds (Interviewee 24)*

Lastly, the patients' triage forms were initially printed out in colour after electronic data entries were completed, with time, print outs were not coloured and nurses had to manually stick colour

codes unto the forms. The affixed colour code was dependent on Total Early Warning Signs (TEWS).

> *When they started the EMR thing, patients' information were keyed on the computer and printed out. It come out with colour code, so when you are done you don't have to put a sticker on it (Interviewee 7)*

Logistics

Participants mentioned that a faster network would be required to run the EMR system:

> *An improved network will be a plus for running the system (Interviewee 1)*

> *We will require a system that works very fast (Interviewee 3)*

> *The system should be fast enough to respond to the triage nurses' (Interviewee 5)*

Also, there was limited internet connectivity and the ED's EMR was run on intranet basis where the LAN/WLAN service was utilized. Concerns were raised regarding future wireless internet access for all staff to use in the ED:

> *I think that there is no wireless so if they have internet connection it will help, internet connection should be in place at all the wards and department so that you do not need to walk but can still disseminate information electronically ((Interviewee 13)*

The ED is a busy place and the need for a waiting area for clients prior to their triaging was emphasized to decrease the congestion at triage:

> *In future we will need a waiting area for incoming patients. The triage area is a busy place we only take few patients at a time (Interview 3)*

The EM IT/Research Office was the engine room of the EMR project. It was at this place that all the resources including the human resource are kept. The room was quite small for all the computers plus accessories and NSP:

> *A bigger office space could be provided in the future to help run the EMR system. This place is small. Sometime some of us can't even get places to sit to work (Interviewee 17)*

Additionally, the hybrid EMR system in use had no automatic backup. Respondents asked for automatic backup of data in the future:

> *Back up could be provided to help support the EMR system. If there is automatic data backup, it is good. We don't have so much to do (Interviewee17)*

Finally, the need to provide a standard UPS at the reception to mitigate the challenges associated with interruption of electricity from the national grid was mentioned:

> *In the future they should have a standard UPS that can last long that will facilitate saving of data during power fluctuations (interviewee14)*

4.4 Barriers of EMR

4.4.1 Existing barriers

The themes identified are; logistical constraints, human and financial resources and data entry errors.

Logistical constraints

The project had many constraints with logistics especially at the initial stage:

Only one tablet and were challenged to use our personal phones which was not acceptable. Printers were in the adjourning room. Resources were not enough (Interviewee 3)

Lack of adequate computers and scanners and external drive, lack of external drive to do backup (Interviewee 17)

Initially logistics to really do EMR, thus equipment to upscale system (Interviewee 21)

As a result, staff had to do routine manual documentation alongside electronic data entry and this has been bringing undue delays depending on the typing speed of the staff:

Patients and attendants wanting faster services; standing on your neck to deliver (Interviewee 9)

Time wasting because there might be a problem with the EMR, EMR functionality is affected when there is a problem with the server. For instance all ten (10) offices that use the system must halt (Interviewee 11)

Records were not doing the inputting fast for us to start. You had to wait long before you could start. Pileup of patients at triage because system was slow at triage (Interviewee 3)

This has affected the full implementation of the EMR at the ED:

System is not started full; likely emergency department would have had access to it because only records has access. Only records so making what it was intended to achieve not yet met. EMR means paperless but see, are these not the papers that we are still writing in, plenty?! Instead, we are going sub-electronic and manual because it has not

taken fully document of patient to type. It is scanned. So triage and others are not done. Therefore will not have been any need for scanning (Interviewee 22)

Also, the network system was occasionally slow, unstable or malfunctioned and this impeded efficiency of the system:

No problem but the service, sometimes it goes off thirty (30) minutes before it comes on (Interviewee 8)

Network break down halts everything ((interviewee11)

The network was very slow (Interviewee 6)

Unstable network so disturbing printing (Interviewee 1)

Moreover, the system had no automatic backup; staff had to do daily manual back up of data:

The existing software application is not reliable in terms of data keeping, because we sometimes loose some important information (Interviewee 18)

System has no backup. There was a time we lost about one and half year's data. Were now filling up (Interviewee 22)

As a result, six (6) months data was lost:

The other big elephant in the room is that about six (6) data has been lost. This is like a wild fire. Fortunately we had an old back up, but we are short of three (3) months. We could no longer do a contemporaneous data entries whiles we enter the "legacy data" (Interviewee 24)

Also, the available UPS was said to be under performing:

> *UPS is not working as it is supposed to last. In fact, it stays on for less than five (5) minutes (Interviewee 7)*

Additionally, the use of the tablet for data entries was unfriendly to majority of the end users:

> *Tablet was too fragile to handle, because we were not used to the keypads it was wasting time in the triage (Interviewee 2)*

> *It was difficult to use the tablet (Interviewee 6)*

> *When we first installed EMR we tried with tablet. Majority of the users preferred not to use tablet but desktop. We got to know this through a small survey we conducted. We thought that tablet was better. People were not comfortable with tablet (Interviewee 24)*

The hard disk capacities of the computers were small and the memory sizes were inadequate considering the chunk of data at stake:

> *Hard disk capacity is small, the more you enter the data, the more it occupies space and slows down the machine. When there is light off, information typed say thirty (30) minutes prior to cannot be found (Interviewee 12)*

> *Inadequate memory to merge patients' scanned folders to their information in the open EMR (Interviewee 19)*

The existing office for keeping EMR logistics and the office for staff for rigorous scannings were not spacious:

> *Lack of bigger office space (Interviewee 17)*

Finally, a few participants reported about the non-functioning state of a desktop computer that was placed in their unit:

> *The desktop computer that they came to fix at the unit is still a "white elephant" (Interviewee 4)*

Human and financial resources

There was no full-time IT personnel employed to run the EMR programme, it was only a computer software programmer whose services were outsourced to customize the EMR to meet ED's needs:

> *We do not have dedicated software personnel around to fix problem so it delays the programme (Interviewee 20)*

> *What we need is a reliable, consistent and timely way. A programmer who can change…It has been constraining finding a programmer to customize the open EMR (Interviewee 24)*

As a result, most of the users reported workload as labour intensive and extra work:

> *We have not stopped in the phase of the challenges. We still face them. It's a tedious job, pulling out and putting back folder together before and after scanning data. We are relying on NSP and they are doing a good job (Interviewee 24)*

> *It gives extra work so an IT personnel should be available to do the keying in to hasten the process (Interviewee 3)*

Staff members do not want to enter data. As at now, the front desk staff write in book and type into computer so they see entry as a problem (Interviewee 20)

Since some of the staffs were yet to adapt to the hybrid EMR system utilization:

Staff attitude; since it's a change process, naturally that people get stuck to old ways, especially records staff and clinical staff (Interviewee 21)

Before open EMR we used to use a book. Established staff used to use a book, extended Excel with fields they fill. It is easy to fill so they easily fill. So some of the data fields are not fields are not filled on the EMR. Some of the data of public health importance and policy health are not filled depending on those on duty (Interviewee 24)

Majority of the participants were not IT inclined and therefore had difficulties in using the EMR system:

It was difficult using the system. More especially for those of us who had no computer knowledge (Interviewee 3)

When there are new staffs, especially NSP we had difficulties because they may not necessarily have been trained before starting work. Programme forget new elements (Interviewee 24)

Moreover almost all the workers are not trained in the area of IT (Interviewee 18)

Also, team work by staff using the EMR was a concern to some of the participants:

Other sections in the information chain if they also do their part can help with a good flow of the chain. In fact, there appears to be not too good team spirit in some units (Interviewee 11)

Moreover, the financial constraints confronting the implementation of the EMR system was a major concern:

Our main challenge is funds and technicians. We have to hire programmer to customize various aspects of the open EMR. This is expensive. In the past, some programmers presented themselves as capable but after 3-4 months they are unable to deliver. This has been the main problem in acquiring and installing the software (Interviewee 24)

This affected the purchase of basic supplies to support the system:

Insufficient inventory, so that basic things as minute as they may look can just halt everything, like stapler (Interviewee11)

Data entry errors

Some participants expressed concern about how certain patients whose Date of Birth (DOB) are unknown is entered in the EMR and multiple registrations of patients:

Sometimes one person having different registration numbers (Interviewee 12)

Data entries challenges data entered incorrectly or incompletely; for instance, entry of DOB. We estimate that about 60-65% of patients who attend accident and emergency do not know their DOB entirely. DOB is a piece of data which is very important which is very important which is unique identifier. Example two people presenting with the same day of birth say Kwadwo Addae and Kwadwo Mensah. Therefore DOB will be an

important discriminator. Telephone number is important at such times if people don't know their DOB. A part of the training, if persons do not know their DOB, the temporary DOB will be first day of that month in that year. If same name, then DOB could serve as a good discriminator. Staff do not appreciate this, if patient attends at day, the day is rather used, this is a big problem (Interviewee 24)

Sometimes patients were brought in by strangers who had limited information about the patient. In such instances patient demographics were not captured:

Unknown details as brought in by some "good Samaritans". You see at the emergency this happens. It makes things difficult for us (Interviewee 9)

During the initial phase of the EMR implementation, there were some errors with data output and printing:

Initially system wasn't ready to be used. We have information like stretcher scoring was a problematic - old stretcher scoring appearing as two (2) and new a well. It wasn't able to print. The blood pressure systolic record 70mmHg that we should not pick, it picks but 200mmHg it couldn't pick. Meanwhile you have entered a higher value. Sometime initially we will go so we have to triage in ward. So in that case after triaging them we have to come back to its entries (Interviewee 7)

Occasionally, inconsistency in data entries occurred as a result of pile up of folders coupled with network challenges affecting reliability of reports generated from the system:

At times it's off so when it's off and you come back you have too much to type in next day, about two hundred (200) names and particulars (Interviewee 16)

Network challenges results in pile up of data which is later typed from book reference. This leads to system giving current date for previous day's entries which leads to inconsistency in entries and different admission statistics (Interviewee 2)

Lastly, participants indicated that the current state of the hybrid EMR at the ED did not permit the generation of clinical reports as data were scanned and not typed:

No generation of clinical data like say top ten (10), can't report on top ten (10) causes of admission. We don't have the knowledge of writing diagnosis like doctors will opportunity of writing so we can use to write our report. In case of medical emergencies or trauma emergencies how many are they? System doesn't allow us to know the history of patient except demography. If someone comes, you can't print out the folder we don't have that opportunity (Interviewee 22)

4.4.2 Perceived future barriers

The themes considered are; data security, logistical constraints and human resource.

Data security

Some participants had concern with privacy and confidentiality of data to be generated from the system:

Privacy and confidentiality issues needs to be considered because if you are going to do entries you can see everything online (Interviewee 1)

Also, legal backing for the ED's hybrid EMR should be considered:

Legislature, now we are small so nobody cares. So if we start to network all of Kumasi that is when the law will require that we go to Parliament to seek approval (Interviewee 23)

Additionally, the occasional power fluctuations in the ED if not addressed could cause data loss:

If everything is connected to the electronic and at the mercy of electricity, huge data loss if the system crashes: it becomes a life and death issue for patients (Interview 20)

If the hospital goes full EMR and the server crashes, everything will be lost (Interviewee23)

Problem of "dum so" if it is not solved, you have to lose some information and retype (Interviewee 12)

Logistical constraints

Some participants expressed that the current system which run on limited resources might extend into future:

Inadequate scanning machine to speed up the work especially when it comes to the folder; inadequate software because the near future the current one we are using might be outmoded (Interviewee 19)

Getting enough equipment (Interviewee 1)

Also, some participants indicated likelihood of the computers breaking down due to the stress on the few available and the poor maintenance culture:

The computers might break down in no time due to the poor maintenance culture of the institution being exhibited (Interviewee 4)

The tablet was only one so it will breakdown (Interviewee 5)

Additionally, few participants perceived difficulties in getting a bigger office or space for the ED EM IT/Research Office:

The likelihood of not getting a bigger office space since office spaces in the hospital are limited is obvious (Interviewee 17)

Moreover, majority of the participants perceived network challenges that made the system slow and unstable could persist if not addressed:

Internet challenges (Interviewee 10)

Network not stable for the system (Interview 16)

Sometimes system runs slow. We are dealing with emergencies. Sometimes within five (5) minutes you have to finish triaging so this is a problem (Interviewee 7)

Human resource

Majority of the participants expressed the need to employ IT personnel to manage the ED's hybrid EMR system:

More personnel to manage the system at the various wards will be a problem (Interviewee 1)

Technical experts to attend to internet problem to prevent loss of patient data because if folder are not at place it will not wait for you. You keeping long patient data (Interviewee 10)

The major reason provided by end users to employ IT personnel to handle data entries was to reduce backlog of data entries:

There could still be backlogs of data to be entered since existing backlog has still not been completed (Interviewee17)

Also, the varying training needs of end users had to be addressed to promote understanding and implementation of the EMR:

Training of personnel and technical staff to support machine (Interviewee 1)

If the staff team does not understand or value what you are doing, in that case they will not be committed (Interviewee 11)

The additional responsibilities of electronic data entry by end users coupled with the manual documentation were of concern to majority of the end users:

The staff are likely to complain about typing (Interview 20)

They will probably be with issues of staff compliance (Interviewee 21)

It gives extra work so an IT personnel should be available to do the keying in to hasten the process (Interviewee 3)

Lastly, a few of the participants had concern with staff idleness in case the system is fully automated:

There would be a `lot of redundancy which would result from staff performance. This will retard the improvement of the entire system (Interviewee 18)

4.5 Suggestions to implement facilitators and overcome barriers

4.5.1 Suggestions to implement facilitators

The themes considered are; human and financial resources, adequate logistics and motivation.

Human and financial resources

Majority of the participants expressed the need to recruit IT specialists and pay them well to run the system efficiently and effectively:

Employ and pay ICT personnel well for their services (Interviewee 20)

Skilled personnel and a lot of equipment, we need a lot of skills and highly trained staff. These will contribute greatly to an efficient and effective EMR services (Interviewee 23)

Like getting someone else to do entry like service personnel; elsewhere there are people who do entry like from morning to 5pm and in the evening nurses do the entry (Interviewee 7)

Also, a few indicated the need for cordial working relationship among the users of EMR:

Have good working relationships with the people and not be intimidated by them. For instance, over here, we all understand each other and freely laugh, share jokes and get along well (Interviewee10)

Additionally, the need for regular meetings among programme implementers to discuss emerging concerns was suggested by some of the study participants:

They can forward it to the administration (Interviewee 17)

They have leaders in this hospital so they have to meet and decide on how to solve this problem (Interviewee 9)

The EMR team should go for a meeting to see the best way to effect EMR system if someone go for consultation (Interviewee 8)

Furthermore, some staff expressed the need for complete attitudinal change that will promote the usage of the EMR by all end users:

Attitudinal change of all staff is required in order to get the system to work (Interviewee23)

If all the end users are using it, because if all of us are using it like nurses, we can get our reports -if doctors are also keeping records of what they are doing for the patients we can get our reports. If all the nurses and doctors are keeping good documentations and entries it will help (Interviewee 13).

The running of this hybrid EMR at the ED was not a funded project of KATH or any specific organization. Some participants therefore suggested alternative funding sources to support the project:

Funds should be generated internally to purchase the additional scanner needed. In terms of training, in terms of training and development programmes the superiors can solicit for funds from external sources such as private business institutions (Interviewee 18)

We need money. Money, lots of it (Interviewee 23)

The hospital could also solicit for funds from donor countries to support the EMR system (Interviewee 17)

Adequate logistics

Majority of the participants were concerned with adequate resources to support the implementation of the system:

There should be enough computers for all staff on duty (Interviewee 4)

Management should purchase the duplex scanner and get the necessary people to fix the machine (Interviewee 19)

Funds could be set aside by the hospital especially to buy computer and scanners to run the EMR system (Interviewee 17)

As a result, end users suggested the need for regular stock taking by programme implementers for prompt restocking of items that would be in short supply and repair of broken down machines:

Inventory aspect once random pass by to see if something is needed or not, that really work (Interviewee 10)

Maybe if the research column can create that book because doing it on the computer takes time (Interviewee 8)

Also, the need for an automatic backup was a concern to some of the participants:

Some particular people among the personnel could be tasked to do daily backup for the system (Interviewee 17)

Backup system in case there is any failure so that it will back up at midnight. That is, automatically back it up (Interview 9)

Motivation

A few of the respondents were optimistic that various forms of motivation will urge staff on to utilize the EMR irrespective of the additional workload:

Motivation as in kind and everything because it was not an easy job; the HOD is very good. He could give snacks during stressful times. In fact, he appreciates our efforts (Interviewee 3)

Also, the need for regular visit by management to offer moral support to the users of EMR and offer assistance where necessary was recommended by some participants:

Monitoring from management, this is good because it helps you to know that what you're doing is important. We're also able to check on the staff to know that they are working (Interviewee 23)

Constantly checking, it has really helped (Interviewee 10)

Moreover, a good working relationship or information flow between end users and core implementers was mentioned:

Encouraging the staff to talk; that is, report if something is spoilt. Also they should not be scolded, otherwise, next time when something is spoilt nobody will report and the work will not be done (Interviewee 10)

Finally, regular updates of end users of progress with EMR usage was also mentioned as a motivational tool by a participant:

Good feedback on how patient care has profited from staff proper entry (Interviewee21)

4.5.2 Suggestions to overcome barriers

The themes identified are; adequate logistics and motivation.

Adequate logistics

Majority of the respondents suggested the need for adequate supply of software and hardware components such as computers, printers, scanners and storage devices for EMR to function successfully:

Printers should be in the screening room so that as soon as you print you get it. Prioritize so that EMR will always be available of personnel and equipment (Interviewee 3)

Management should purchase additional scanner to make work faster. More options should be considered in terms of software application development to catch up with the fast changing world (Interviewee 19)

Acquire big hard disc, use external disc like pen drive, hard drive so that you don't lose information or have to retype (Interviewee 12)

Also, a few respondents suggested a more spacious office to accommodate the EMR resources:

A bigger office space should be provided by the hospital (Interviewee 17)

Moreover, frequent power fluctuations which had been raised on several instances were reiterated and most of the participants suggested automatic power shift from the national grid to the electricity plant of KATH:

> *So we need to get power back up. Users are few so if the server can contain all of us. The backup sometimes if you can backup it will be in two things, when there is a backup and the link goes off, we can go into the system. If light goes off we may have to go for generator or manual source of work so when power is restored we can enter those data (Interviewee 22)*

> *Plant we're using here is not standard so they will have to change it (Interviewee 12)*

> *Could there be any other things that will facilitate the system to run fast or boost up system. With the generator, if there is something that can put on so that as soon as system goes off it can come on (Interviewee 7)*

Furthermore, the issue of automatic backup system was repeated as a suggestion to retrieve data for emergency care at the time of system failure:

> *The data should be backup all the time as often as possibly, preferably, automatic (Interviewee 20)*

> *Have backup system like Excel, a system that when this one goes off they can use the other one until the system comes back (Interviewee 16)*

> *There should be constant backup to save the system from crashing. We petitioned the IT team of the hospital to do regular backup for us although they do a monthly backup (Interviewee 24)*

Also, the system should be programmed to identify previous registrants to curtail double registration:

> *They should put in re-encounter feature to avoid duplication, possible duplication of entries (Interviewee 2)*

Finally, a few of the participants suggested other alternatives to typing to reduce workload on clinical staff:

> *Instead of typing, they can try a speech-to-text engine so that instead of them typing, they will talk into microphone or mobile device to do the typing. Also instead of typing into text boxes; we can check boxes, radio boxes and combo boxes-selection boxes (Interviewee 20)*

Motivation

The suggestion of providing incentives to staff for using the EMR system was reiterated by a few of the respondents:

> *Motivate or provide adequate motivation when and where need be (Interviewee 19)*

Also, the understanding of the EMR system through trainings was suggested by most of the participants:

> *Everyone in the chain should be made to understand the whole system. The role he/she plays can really go a long way. Training and constant reminder will help (Interviewee 11)*

For management and everyone to realize that this is the way to go - if fire outbreak occurs, to realize that this is beneficial, to make useful investment. There should be training, sensitization and creating awareness among health workers (Interview 21)

Urgent training and development programmer should be given to new workers and existing workers to avoid future redundancy. This should be continued for staff to be abreast with new development in IT field (Interviewee 18)

Finally, developing and promoting a nationwide policy on EMR was suggested by few of the participants:

Very open door policies so opinion leaders, say hospital administration, chief executive officer, GHS, Ministry of Health (MOH), office of the president; so everybody to understand (Interviewee 23).

CHAPTER 5

5.0 DISCUSSION

5.1 Introduction

This chapter critically considers discussion of the objectives set for the study.

5.2 Description of the EMR programme

The hybrid EMR at KATH has been piloted for three years with the prime objective of improving emergency care through data persistency (see section 4.3.1). This objective has been fully embraced by majority of the ED staff who willingly support the EMR project: *Dedication of team of personnel, in fact, they have been good. Each day there is so much to do yet we willingly do it because our supervisors want the best for their clients. Educate people more on it so that they can embrace the system because eventually, the folders wipe off and the older system of keeping records where folders are missing will be stopped (Interviewee 10)*

Currently, the system performs basic functions of documentation and scanning. This limits its ability to generate clinical reports and contribution to improving the quality of emergency care through advocacy and research, as indicated in section 4.3.2. Thus, the prime role of using EMR as recommended by WHO (2006) in promoting clinical care through efficient and effective electronic record keeping is a mirage. It is however hopeful that future up scaling of the programme from its current state of documentation and scanning to a fully operational EMR will provide comprehensive services such as clinical data repository, clinical decision support, controlled medical vocabulary, order entry, computerized provider order entry, pharmacy, laboratory, radiology and clinical documentation applications similar to suggestions by Dobrev et al (2008) and Gartner (2012). This might serve the intention of setting up EMR at KATH ED.

The components of KATH ED's EMR were freely downloaded and customized open source EMR software, computer software and hardware, server and network as indicated in section 4.2.3. This is similar to other EMRs found in developing countries as reported by a studies conducted by Kalogriopous et al (2008) and Asabe et al (2013). The utilization of the open source EMR makes the system's management dependent on the readily availability of skillful permanent IT personnel for the implementation and maintenance of the EMR (Kalogriopous et al., 2008). However, the EMR at KATH ED had no permanent IT personnel to do data entries, promote capacity building and training, promptly repair broken down machines and resolve network challenges. This might be because the project was confronted with financial challenges to employ permanent IT personnel and to purchase other logistics needed for full implementation of the project: *Our main challenge is funds and technicians. We have to hire programmer to customize various aspects of the open EMR. This is expensive. In the past, some programmers presented themselves as capable but after 3-4 months they are unable to deliver. This has been the main problem in acquiring and installing the software (Interviewee 24).*

As a result, staff work load increased as staff had to perform their routine clinical activities in addition to data entries which were done at varying speeds. This created back logs of data to be entered and data loss as stated in section 4.4.2.

The systems inability to encrypt data made it liable to other unintended end users as stated by a study a participant: *Privacy and confidentiality issues needs to be considered because if you are going to do entries you can see everything online (Interviewee 1).* This might compromise patients' privacy and confidentiality rights. Therefore it might be possible for patients to seek for legal redress for breach of their privacy since this contradicts the HIPAA 1996 (Federal Register, 2013).

5.3 Facilitators of the EMR

The project had the full commitment and involvement of the ED's internal management committee to ensure that the system was working (See section 4.3.1). This encouraged the other staff to readily use the EMR and made it easy for staff to report challenges encountered in utilizing the system to be fully addressed promptly as stated in section 4.5.1. This buttresses the views of Robertson et al (2010) and Mair et al (2012) findings that the involvements of institutional leadership are pre-requisites for the successful adoption of EMR systems. This might explain the cordial relations and team work that existed among the staff in terms of easy follow of information and sharing of ideas as stated in section 4.3.1 and 4.5.1.

The staff initial exposure to the EMR during the orientation, coupled with their previous IT knowledge made the use of EMR friendly as cited by most of interviewees in section 4.3.1. Therefore it is worthwhile to create and maintain regularized trainings and capacity building avenues for both new and odd staff to enhance the effectiveness and efficiency of the EMR system (Boulus, 2005). This might justify why staff identified lack of permanent IT personnel for the project as a barrier to successful implementation of the project. This is because, full time IT personnel could be given additional responsibility of organizing refresher trainings for existing staff and trainings for newly recruited or transferred staff. This might promote efficiency and effectiveness of the system.

Also, some logistics such as tablet, printers, scanners, desktop computers, intranet system, an office space and provision for single registration of patients were available to enhance the use of the system as stated in section 4.3.1. Moreover these logistics were crucial for the implementation of the EMR project. However, the logistics were inadequate to support the various demands of the ED's EMR. This resulted in occasional delays in attending to patients;

data loss and unstable network (see section 4.4.1). These findings support Linder et al (2008) and Zandiel et al (2014) studies where inadequate printers and slow computers resulted inability to print and type quickly.

5.4 Barriers to EMR use

The hybrid EMR system at the ED was confronted with inadequate funding (See sections 4.2.5 and 4.4.1). This is contrary to EMR use in countries such as the USA and Australia where monies were budgeted for at the national level for EMR adoption (Accenture, 2010). The absence of funding has constrained the project in diverse ways as evident in the provision of inadequate logistics such as printers, scanners, computers, spacious office, UPS, automatic data and power backups to run the system as stated in section 4.4.1. This resulted in delays in providing care to patient, possible data loss and continuous break down of machines due to pressure exerted on the limited few (See section 4.4.1). Therefore the prospect of improving the productivity in emergency care at the ED through EMR usage is challenged by the delays in providing care (McGinn et al., 2014; Acheampong, 2014). Moreover, the lack of funding for the project might have caused the prolong phase of the piloting of the ED's EMR and possibly incapacitate the system's ability to upscale to a fully operational EMR. Thus, the critical role of financial resource in the implementation of EMR cannot be underestimated (DesRoches et al., 2008).

Moreover the lack of support from the KATH's management for the clinical EMR at the ED as opposed to the administrative EMR constraints the readily availability of resources for running the ED's EMR (see section 4.5.1). This is contrary to the recommendations by Kamadjeu et al

(2005) where the active involvement of facility heads/management promoted EMR adoption in Cameroon. Thus the support of all leadership is important for EMR use in institutions.

The small office limits the number of staff and material resources utilized for the EMR implementation (see section 4.5.2). This agrees with recent report by Zandieh et al (2014) that the quality of space needed for computers can impede EMR use. Thus, the convenience of personnel who scan the ED's medical records is important.

5.5 Suggestions to implement facilitators and overcome the barriers of EMR

The respondents called for support from various agencies such as the core management of KATH, businesses and donor countries to assist the ED in implementing the EMR (see section 4.5.1). This supports Kalogriopous et al (2008) suggestion that developed countries should provide assistance to developing countries in adopting EMR. As a result, support from the KATH management and other organized groups for the clinical EMR to assist in achieving the objective of the project will be enormous to the project. The support can be inclusive of resources such as computers, printers, scanners, internet connectivity, spacious office space, automatic data and power backup facilities, funds, reliable and persistent services of skilled IT personnel.

The lack of a national policy for EMR use which was reported by Lubeck and Healy (2012) and Achampong (2012) during their study of Korle- Bu Teaching Hospital remains a challenge to EMR use. Therefore some respondents suggested the need to enact open door policies to promote EMR adoption in the health sector in Ghana (see section 4.5.2). This should involve various stakeholders at the community, institutional, regional and national levels. The intent is for stakeholders to support the implementation of EMR in Ghana thereby promoting the quality

of care given to all categories of patients that patronize health care in Ghana. These policy strategies should focus on financial support, training of technical support staff on EMR, interoperability, adaptability and flexibility of EMR usage (Jha et al., 2009; Robertson et al., 2010 and Mair et al., 2012). The setting up and implementation of these policies with regular reviews contribute to successful implementation of EMR (O'Malley et al., 2009).

CHAPTER 6

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTON

This chapter provides conclusions based on findings of the study and makes recommendations to promote emergency medicine with particular emphasis on EMR utilization.

6.2 CONCLUSIONS

Description of the EMR programme

The KATH ED EMR was hybrid, it has been piloted for more than three years but it was still basic – documentation and scanning of clients records. The end users were triage nurses, medical records staff and NSP stationed at the EM IT/Research Office. Customized open source EMR software was in use. There were ten computers, two scanners and one printer in use with RAM of 512MB-4GB; hard disc capacities of 40GB-3TB and processor speed of 1GHz-16GHz. The operation system was Linux Ubuntu and Windows and the network was LAN/WLAN. Data management involved basically the bio-data of the patient – demographics and encounters. Each end user had a user name and password with limited privileges. The project had no funding.

Facilitators of EMR

The existing facilitators identified were available logistics such as computers, scanners, server and printer; capacity building and trainings on EMR for all users before implementation, moral support from the ED management and core implementers and end users were intrinsically motivated to see to the full implementation of the EMR system. Human resource in the form of hiring full time IT personnels to assist in data entries and the running of the system; regular in-service training for all users, motivation in the form of the ability of the system to be able to

generate data for advocacy and research purposes; support from KATH management and logistics such as internet connectivity, a faster network system, automatic backup system, a standard UPS to contain all the load during power outages were mentioned as perceived future facilitators.

Barriers of EMR

Logistical constraints such as absence of standard UPS, automatic data and power backups, human resources challenge such as lack of full time IT personnel, financial constraints, poor staff attitude towards data entries, increased staff workload and data entry errors such as inconsistencies in DOB entries and multiple registration of patients were mentioned as existing barriers. However, data security notably absence of legislature, inadequate data security features and data loss; logistical constraints such as inadequate office space and human resource such as the need to employ more full time IT specialists were identified as perceived future barriers.

Suggestions to implement facilitators and overcome barriers

The suggestions to implement facilitators included; human and financial resources to manage the system, to assist with data entries, to support trainings and capacity building; adequate logistics such as computers, printers, scanners, adequate office space and extension of the programme to other units within the ED other than triage and medical records.

Also, adequate logistics through the provision of support from alternative sources such as business enterprises, donor countries and KATH management and motivation through the establishment of open door policies at the national and institutional levels were mentioned as suggestions to overcome the barriers identified.

6.3 RECOMMENDATIONS

1. The KATH management, private organizations and donor countries should extend financial support to the KATH ED EMR project. This will facilitate the the employment of permanent IT personnel to manage the project and improve data security through the provision of automatic data and power backups.

2. KATH ED EMR core implementers and MOH, Ghana should adopt the findings of this study as baseline for EMR implementation in Ghana. In addition, MOH Ghana should establish national EMR policies and make provisions to support healthcare facilities to adopt the system.

3. A further study is required to determine the cost benefit analysis of the KATH ED EMR implementation.

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APPENDICES

Appendix 1

EMR information sheet

Title of Research: USE OF ELECTRONIC MEDICAL RECORDS IN EMERGENCY CARE AT KOMFO ANOKYE TEACHING HOSPITAL

Name(s) and affiliation(s) of researcher(s): Ms Adwoa Gyamfi of the School of Public Health (SPH), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi

This information sheet explains the research study you are being asked to join. Please listen carefully as I read it to you, and take as much time as you need. You may ask questions at any time about anything you do not understand. You are a volunteer. You can choose not to take part in this study, and if you join, you may quit at any time. You will not lose anything if you decide to quit the study.

This study aims to evaluate the use of EMR in emergency care at KATH. It is being conducted by Adwoa Gyamfi of SPH KNUST, Kumasi.

You are being asked to take part in this study because you are a core implementer or end user of the EMR at the KATH ED. We expect that a minimum of 15 and a maximum of 24 staff at the ED will join the study. If you join, we will ask you questions about your experience with the EMR usage.

You may find some of the questions difficult to answer. You do not have to answer any question you do not want to answer, and you can stop the interview at any time.

We will not record your name on any of the study documents. We will conduct the interview in a convenient, quiet, and private space to ensure that no one other than you and the interviewer can hear your responses.

The information that you provide during the interview will be kept private and there will be nothing to link the information you provide to you. The only people who will have access to information you provide during the interview are members of the research team. We will not share the information you provide with anyone outside of the research team.

There is no direct benefit to you for being in the study; but the information you provide during the interview may help improve emergency care in Ghana and globally.

Do you have any questions?

If you have any questions about the study, please contact Adwoa Gyamfi on 0242 351 504.

If you have any concerns about the conduct of this study, your welfare, or your rights as a participant, you may also contact: The Chairman of the Committee on Human Research and Publication and Ethics, Kumasi. Tel: 03220 63248 or 020 545 37 85

Appendix 2

EMR interview guides for core implementers and end users

Core implementers

1. Please tell me all that you know about the EMR programme in your emergency department.

2. In your view what are the existing facilitators and perceived future facilitators of EMR implementation in your emergency department?

   Existing facilitators

   Perceived future facilitators

3. In your opinion, how can the perceived future facilitators be implemented?

4. In your opinion, what are the existing barriers and perceived future barriers of EMR implementation in your emergency department?

   Existing barriers

   Perceived future barriers

5. Suggest how the perceived future barriers can be overcome

End users

1. In your view what are the existing facilitators and perceived future facilitators of EMR implementation in your emergency department?

   Existing facilitators

   Perceived future facilitators

2. In your opinion, how can the perceived future facilitators be implemented?

3. In your opinion, what are the existing barriers and perceived future barriers of EMR implementation in your emergency department?

   Existing barriers

   Perceived future barriers

4. Suggest how the perceived future barriers can be overcome.

Appendix 3

Ethical clearance

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/288/15 — 27th July, 2015.

Ms. Adwoa Gyamfi
C/O Nana Ama Gyamfi
Post Office Box KS 15854
KUMASI.

Dear Madam,

LETTER OF APPROVAL

Protocol Title: ***"Use of Electronic Medical Records in Emergency Care at Komfo Anokye Teaching Hospital."***

Proposed Site: ***Komfo Anokye Teaching Hospital, (KATH) - Kumasi.***

Sponsor: ***The Fogarty-Quartey Scholarship Secretariat, Ghana.***

Your submission to the Committee on Human Research, Publications and Ethics on the above named protocol refers.

The Committee reviewed the following documents:

- A notification letter of 22nd April, 2015 from the Komfo Anokye Teaching Hospital (study site) indicating approval for the conduct of the study in the Hospital.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, renewable annually thereafter. The Committee may however, suspend or withdraw ethical approval at anytime if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you Madam, for your application.

Yours faithfully,

Rev. Prof. John Appiah-Poku
Honorary Secretary
For: CHAIRMAN

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