

# Impact of Electronic Health Record System (EHRs) on Healthcare Quality at Asamankese Government Hospital, Ghana

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## Abstract

The main objective of this study was to explore the impact of EHRs on healthcare quality at the Asamankese Government Hospital. The research used three objectives thus, explore the use, behavioral intent and the impact of EHRs on healthcare quality among clients and staffs of the facility. This is qualitative research with a case study design with data gathered through interviews from five clients and eight staffs. The study proved all departments of the Hospital were fully using EHRs with all respondents willing to continue its use. The key findings of the study were, firstly, improved storage and quality of medical records and easy retrieval of records by healthcare practitioners. EHRs reduces administrative and operational cost. Thirdly, EHRs improves client safety, staff productivity and efficiency healthcare delivery. Furthermore, it reduces clients' waiting time, waste of resources and helping track expiry dates of medications and improves health outcomes. Finally, EHRs improves triaging and responsive care and the personal healthcare of clients thereby improving clients' satisfaction on services rendered at the facility. The EHRs however faced challenges such as unstable internet network, electricity instability, inadequate training of staffs, etc. The study concludes EHRs has improved healthcare quality at the Asamankese Government Hospital

## Introduction

### Brief Analysis of the Topic

Information and Communication Technology presents several opportunities for improving the performance of health systems in developing countries and has become a major transformational part of enhanced healthcare especially in the aspect of patient safety, quality of care and reduction of medical errors [1]. Electronic health record (EHR), also referred to as electronic medical records (EMRs) is a repository of electronically maintained information about an individual's lifetime health status and healthcare, stored such that it can serve the multiple legitimate users of the record [2]. The EHRs easily stores, retrieves, uses, and exchange patient data/information among health workers and relevant agencies to aid in decision making.

The Institute of Medicine (IOM) in 1990 defined quality as "degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge". It determines the satisfaction level of patients, the frequency of patients revisiting a facility, serving as a measure for improving healthcare. The Electronic Health Records system has been linked to improved quality of care in healthcare due to its efficiency, effectiveness, timeliness, among other benefits.

Several studies conducted in Ghana concerning the electronic health record system including; have thrown less light of the impact of EHRs on healthcare quality. There is therefore the need to conduct a study on the impact of EHRs on healthcare quality to fill this gap [3-5].

## Aims and Objectives

### Main Objective

The main objective of the study is to evaluate the impact of EHRs on quality healthcare at Asamankese Government hospital with the ultimate goal of measuring the quality of care using the Hospital's method, structure and outcome of EHRs.

### Specific Research Objectives

- To study the use of EHR at the Asamankese Government Hospital
  - To underscore the behavioural intent on the use of EHR among staffs and clients of the Hospital
  - To evaluate the impact of EHR on quality of care among the hospital staffs and patients in Asamankese Government Hospital.
- Research Question
- What are the uses of EHR in Asamankese Government Hospital?
  - What are the behavioural intents on the use of EHR among staffs in the facility?
  - What impact does EHR have on healthcare quality among staffs and patients in facility?

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## Methodology

This is primary research using qualitative research method and case study design. Qualitative research methods include action research, case study, ethnography, grounded research, etc. (Myers, 2009:8). Case study design involves an attempt to describe relationships which exist in reality and generate deep understanding of complex issues [6]. Data will be mainly collected through observation, interviews. This would aid researcher to generate adequate data to test the hypothesis that, EMRs has an impact on quality of care at the Asamankese Government Hospital.

## Synopsis of the Chapters

The study has four chapters. Chapter one presents a general literature review on information technology in health whilst chapter two comprises of specific literature review on electronic health record system, quality of care, ethical review and other relevant theoretical evidences. In chapter three, the methodology of the study shall be broken down into research design and the procedure for data collection and analysis. The study is then analyzed, interpreted and discussed to bring out the impact EHRs has had on healthcare quality at Asamankese Government Hospital. The next chapter is a general review of the relevant journals, studies, etc. pertaining to the current study touching on the general overview, history and benefits of EHRs as well as general explanation of Quality of care.

## Chapter One – Literature Review

### Introduction

This chapter and the next presents a review of literature on the impact of Electronic Health Record System (EHRs) on quality of Care. It has become essential to divide the literature review into two chapters so as to serve readers with needed understanding of the various facets of the study. The literature review one presents a general concept on the electronic health system and quality of care, discussing into details its meanings, overviews and intrinsic analysis of the salient words and concepts. It begins by briefly touching on records keeping in healthcare and then presents an overview of EHRs, explaining some concepts and then goes through its components. It further reviews the history of EHRs with a link to its implementation in Ghana and its benefits and challenges. The chapter continue to review the concept of quality of care, its components then discuss the five principles of quality. It ends with a summary of the topics discussed. The next chapter also reviews the more specific literature on the connection between electronic health system and healthcare quality, how it has been measured in the healthcare industry and present the theoretical and conceptual framework adopted for the study.

### Records Keeping In Healthcare Industry

Records keeping is a major part of any industry and the healthcare sector is not an exception. Keeping personal health information of clients is such an important aspect of healthcare that needs the best of attention and security. Berg & Toussaint opined that, health record systems help in the accumulation of data gathered during the course of a patient trajectory, which in turn help create an ‘external

memory’ for future use as well as in coordinating activities and events at various departments and even other geographical locations (2003:225). There are two major ways of keeping records in the healthcare industry namely the paper-based record system and the electronic health record system. The paper-based record which used to be the main means of health records keeping presented a lot of challenges such as missing folders, misplaced laboratory report, etc. [7]. Explained that, the paper-based system alone is just not good enough anymore as it presents various challenges including no guarantee for information backup, difficulty in accessing and sharing medical history of patients, improper organization of patient records, breach of patients’ privacy and error in prescriptions and Medications. It is in this light that many health facilities have adopted the use of the electronic health record system to curb such challenges, which has prompted the researcher to study its impact on healthcare quality. The literature below discusses more details of the EHRs.

### Overview of the Electronic Records Health System

The healthcare industry has witnessed massive application of information and communication technology with the introduction of the Electronic Health Record system (EHRs). International Standard Organization (ISO) (2005) described EHRs as “a repository of data regarding the health of a subject of care in computer processable format”. EHRs have been used in the United States of America in one form or another since the 1960s. Between the years of 1960 and 1970 a fast-evolving healthcare system arose after the federal government of the United States of America passed laws to establish Medicare (Seymour et al 2012:202). For many years, the Institute of Medicine had been urging the medical community in the United States to adopt electronic health record arguing that it would improve quality of healthcare by making it safer and more efficient [8]. Many law suits against healthcare organizations arose after the 1960s after the influx of many and innovations entities in the healthcare industry and with health been seen as was vital, a stricter industrial legislation was implemented by the United States [9]. Therefore, the dare needs for better medical records in healthcare became intense hence the massive adoption and implementation of the electronic health records system by many healthcare facilities. A quote in President Bush’s speech at the Health Institutes in 2005 on the current healthcare system stated that the Americans have a 21st century medical practice full of innovation which was still running on a 19th century paper-based system. He also added that, the electronic medical records were an excellent development that had the potential of improving health. EHRs includes all health record/data such as the health profile, behavioral and environmental information of a patient, etc. EHRs is a systematized collection of patient’s data which is stored electronically. EHRs makes it possible for patients’ health records/data to be shared across different healthcare settings through an interconnected network. Thus, EHRs is designed to solve the many limitations of the paper-based record system and thereby improving the quality of care (Tang & McDonald 2006:447). Ghana’s ministry of health, underscored the need for the implementation of EHRs

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(Ghana E-Health Strategy 2009:8), which is currently in progressive stage with many Pilot projects in some hospitals. A scientific study done in four premier Ghanaian hospitals namely, Komfo Anokye Teaching Hospital (KATH), Korle-Bu Teaching Hospital (KBTH), Tamale Teaching Hospital (TTH) and Effia Nkwanta Regional Hospital (ENRH) showed that only KATH was partly ready and had an EHRs in place, whereas the others either had non or not ready for it or in the process of applying it. User adoption was small in KATH and the hospital found it hard to maintain information, thereby adding to the problems of moving to a complete EHRs scheme. As of today, few hospitals in Ghana are fully electronic with many being either partial or operating the paper-based system [10-16].

### **Definitions**

#### **Computer-Based Patient Record (CPR)**

It was introduced in the 1990s in the USA and described as a compilation of the health data of a patient related to the identification of a patient. Over a long span of time, the CPR may contain as few as one episode of patient care or health care information [17, 18]

#### **Automated Health Records (AHR)**

Collection of computer-stored pictures from traditional health records which assist accessing, storing and controlling paper-based files but failed to fix patient input / output.

#### **Electronic Medical Record (EMR)**

Defines a digital scheme based on imagery of documents or schemes set up in a medical practice or community health center including patient identity data, medication, and generation of prescriptions and outcomes of the laboratory [19].

#### **Components of EHRS**

The Electronic Health Records system has a multi-functional health system used to store, retrieve, communicate and disseminate medical data/information among health personnel. Tang & McDonald proved that an efficient EHRs should be capable of longitudinally storing patient health information and data, correctly managing the outcomes produced from the scheme, facilitate electronic communication and connectivity, provide assistance for patients and assist in administrative procedures and reporting. EHRs software have features such as demographics records, clinical documentation (general out-patient department/in-patient con-

sult), booking, communication, laboratory, pharmacy, accounting, billing among others [20].

#### **Structure of Electronic Health System (EHRS)**

To further divulge the structure of EHRs, the study adopts the Dickinson, Fischetti and heard structure of EHRs which expands three structures or functions of every effective EHRs classifying them as; direct care, supportive requirement and Information Infrastructure (2004:5). Figure 1 below expunge more on the structure of EHRs based on Dickinson et al. cited in [21].

##### **The Direct Care Functions**

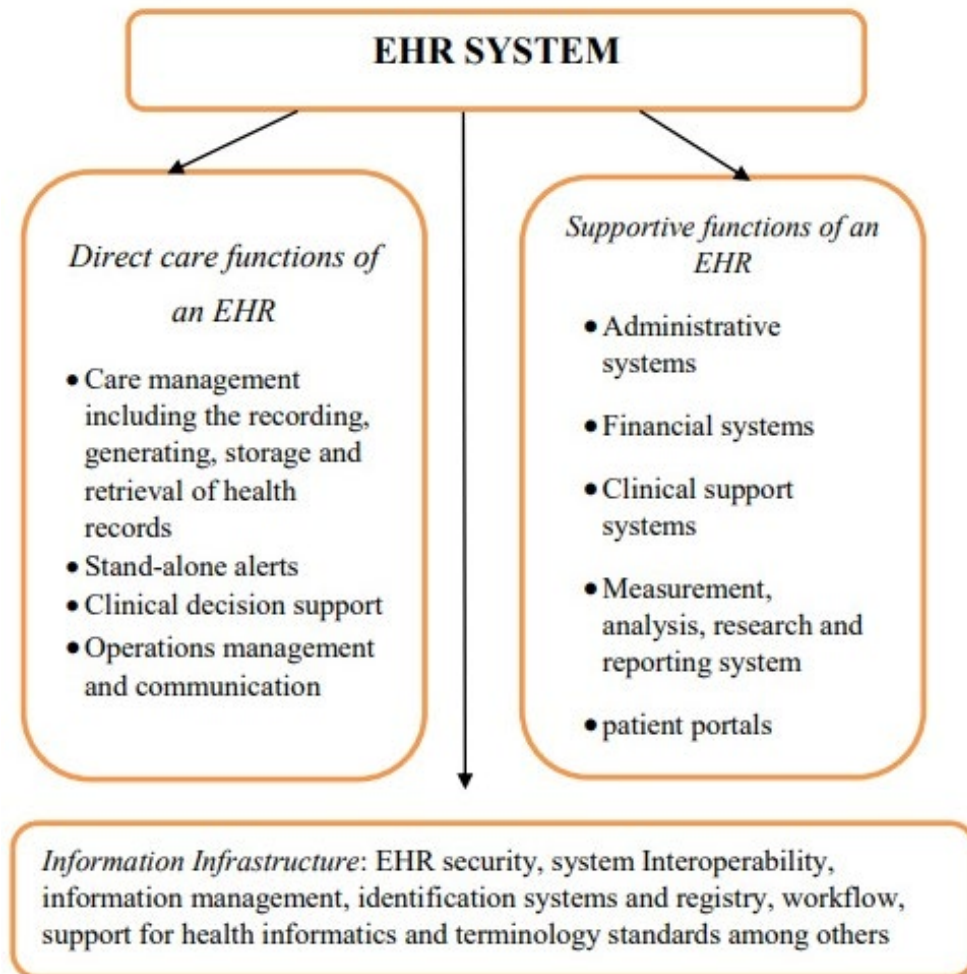
According to Dickinson et al, every EHRs carries out functions associated with general clinical tasks involving the recording or retrieval, storage, management, generation and communication of health information that are directly definable with the provision of healthcare which in effect ensures the delivery of require care to clients. It specifically involves patient's history taking, examination and evaluation of investigative results, diagnosis and treatment plan for patient, planning and carrying out interventions. This function again has task tracking features to ensure timeliness in the provision of care.

##### **The Supportive Functions**

Dickinson et al, cited in describes this as a compliment of direct provisions of healthcare that is relevant in the overall delivery of healthcare but do not directly relate to the provision of healthcare. It explains that, the function improves quality of healthcare delivery through provision of relevant inputs for medical research and promotion of public health as well as providing assistance for general administrative and financial management such as assigning and optimizing patient bed, providing health guidelines and resources, assigning financial/billing coding and tracking of providers' location in the facility.

##### **The Information Infrastructure Function**

An Informative component, relating to the provision of technical groundwork for the successful achievement of the direct and supportive care functions and as well enhance interoperability or the achievement of the direct and supportive care functions and as well enhance interoperability or the exchange of clinical and administrative between healthcare organizations. Exchange of clinical and administrative between healthcare organizations.



**Figure 1:** Structure of EHRS based on Dickinson et al. cited in acquah-swanzy (2014:22).

### Benefits of EHRS

The implementation of EHRs presents users with many benefits. The Institute of Medicine in November, 2011 revealed that, when properly designed and used, health IT is anticipated to assist improve health professionals' efficiency, decrease operating / administrative expenses and improve patient security. Kalra on the other hand opined that it enhances completeness, efficiencies, integrity, precision of health documents, timely and accessibility of documents (2006:137). Physicians using EHRs are more likely to achieve better service delivery outcomes, including e-consults, e-billing, e-prescribing, and set aside same day appointments, as compared to their counterparts without EHR use [22]. The benefits of EHRs also include enhancing/quality improvement of patient documentation, communication, easy and quicker billing and error reduction such as prescription mistakes According to Acquah-Swanzy. EHRs has curbed the perennial problem of missing patient records providing the physician with the previous diagnosis and treatment of the patient which enhances quality care. Randeree stated that the introduction of EHRs has enabled healthcare institutions to reduce cost and increase efficiencies since practitioners

get the information they need exactly when they need it. EHRs improves the medical documentation, decreases medical errors and general healthcare costs [23]. Finally, EHRs ensures proper data protection and security, enhances efficiency, effectiveness, improves care and increases productivity in the healthcare sector. EHRs process is transparent enabling access to whatever has been written concerning the patient at various points by the caregivers as well as provides easy access to patients' information.

### Challenges of Electronic Health Records System

EHRs aside its benefits have some challenges as certain difficulties needs to be cracked to ensure health facilities enjoy the benefits EHRs bring to healthcare. Challenges such as lack of infrastructure, lack of basic knowledge, poor electricity supply among others have been identified. Four of the challenges and discussed below.

### Cost of Implementation

The enormous expense for acquiring EHRs poses a challenge for healthcare management. The high cost of purchasing computers, servers and other accessories can be a huge turnoff for many hos-

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pitals in developing nations. Aside this, the cost of maintaining EHRs such as computers, servers, internet cost, etc. as well as cost of training staff/users also poses a challenge especially in poor economies.

### **Poor Internet Connectivity**

EHRs require a good and stable internet connectivity in order to operate well, a service which is poor in developing and low-income nations although there have been massive improvements. Poor/limited internet connectivity causes internet congestion/jam affecting early retrieval of patient data (Acquah-Swanzy 2015:33) thereby negatively impacting the effectiveness of diagnosis and treatment regimens.

### **Resistance to New Technologies**

Healthcare professionals may resist the use of EHRs because it may be new to them especially those who have less knowledge in using computers. The fear that introduction of new EHRs might alter existing work practices, or interrupt workflow can be a challenge [24].

### **Lack of It Infrastructure/Skills**

Most developed countries like United State, United Kingdom, etc., has a robust healthcare infrastructure with technologically inclined personnel and have embraced EHRs with ease due to their advancement in technology but same cannot be said of many developing nations. Healthcare managers in various health facilities trying to implement EHRs in developing countries are overwhelmed with the lack of ICT resources (such as unavailability of computers), weak healthcare infrastructure and less knowledge and skills of staff in information technology. This is has become a hindrance in adopting EHRs in many developing nations.

### **Quality of Care**

Quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge. (Institute of Medicine 1990). Quality of care is very important in patients' care as it determines the satisfaction level of patients, the frequency of patients revisiting a facility with same complain as well as serves as a measure for improving healthcare. This proves quality of care is measurable and ultimately aims at health improvements rather than simply increasing service inputs or refining system processes, and should reflect the desires of key stakeholders, including service users and communities [25].

### **Components of Healthcare Quality**

Health system should seek to make improvements in six areas or dimensions of quality thus, it should be:

#### **Effective**

Delivering health care that is adherent to an evidence base and results in improved health outcomes for individuals and communities, based on need.

#### **Efficient**

Delivering healthcare in a manner which maximizes resource use and avoids waste.

#### **Accessible**

Delivering healthcare that is timely, geographically reasonable, and provided in a setting where skills and resources are appropriate to medical need.

#### **Acceptable/Patient-Centered**

Delivering healthcare which takes into account the preferences and aspirations of individual service users and the cultures of their communities.

#### **Equitable**

Delivering healthcare which does not vary in quality because of personal characteristics such as gender, race, ethnicity, geographical location, or socioeconomic status.

#### **Safe**

Delivering healthcare which minimizes risks and harm to service users. Donabedian suggested that, the structure, process/results and outcome are three components to assess quality of care and further explained that structural measures had an effect on process measures, which in turn influenced outcome measures and together form the foundation for an efficient package of interventions that is required.

### **Quality Principles in Promoting Healthcare**

Buttall et al stated that, quality consists of the degree to which health services for individuals and populations increase the likelihood of desired health outcomes (quality principles), are consistent with current professional knowledge (practitioner skill), and meet the expectations of healthcare consumers (the marketplace) and identified five principles for promoting quality in healthcare.

#### **Leadership**

Buttall et al expressed that, leadership is the ability to influence and change behavior to reach specific goals within an organization. The writers' further states that genuine leadership in healthcare drives success through many elements such as process improvement, risk awareness, communication, and innovation in achieving the targets of service and clinical performance to the desire of patients/clients, which is sustained by promoting a sense of personal ownership of the processes and outcomes of the care patients receive in a health facility.

#### **Measurement**

Quality of care evaluations can be grouped in terms of one of three measures: structure, process, or outcome (Donabedian 2005:713). Structure refers to traits of the individuals who provide care and of the settings the care is given including the education, training, and certification of professionals involved in care giving and the adequacy of the facility's staffing, tools, and overall organization

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composition. Process: It explains the mode and how the system at the health facility work out taking into consideration timeliness, appropriateness and skills. Outcome: Quality improvements outcomes can be measured through reduce length of admission, reduced mortality, reduced waiting time, decreased nosocomial infection, value for money, etc.

### **Reliability**

Looks at how others trust and are willing to put their health in the care of a facility/organization. In evaluating highly reliable organizations, five principles have been found to be universal, thus command and control, risk appreciation, a specific quality component of the industry, metrics driving management, and reward [26].

### **Practitioner Skills**

The process of achieving consistently high quality of care in a reliable way consists of “doing the right thing right”, requiring physicians, nurses, and all healthcare providers to make the right decisions on appropriateness of services and care for each patient (high-quality decision making), and to do it right requires skill, judgment, and timeliness of execution (high-quality performance).

### **The Marketplace**

This refers to the setting and ways in which products and services are rendered. The marketplace has had a profound effect on moving hospital quality forward, and it is essential to understanding the role of quality of care in the current environment of healthcare. This principle looks at the competitors to the health facility, the services they render as against their charges and effectiveness as well as their customer care, expertise etc. The basic economics in healthcare are similar to most industries and involve the management of three main principles: cost, volume, and revenue. Once health facility managers understand the economic situation of their environment and optimize their cost, provide the needed expertise with the best of customer care, it increases its level of quality thereby raising satisfaction levels of patients.

### **Summary**

The chapter presented a general concept on EHRs and quality, talking about components, structure, and history with a link to its implementation, benefits and challenges. The literature indicated that, reduction of cost, improvement of quality and increased efficient and effectiveness with some of the direct benefits of EHRs although challenges such as poor internet connectivity in many developing nations is hindering its implementation. It further explained quality of care, its components, its principles such as through leadership, marketplace, etc., were not left out. The literature expanded much more general understanding of the study which would be relevant in the next chapters of the study. We discuss the specific literature review on the impact of EHRs on quality of care and then expose the theoretical and conceptual framework adopted for the study.

## **Chapter Two – Literature Review**

### **Introduction**

The chapter breaks down the more specific concept of the study by analyzing various literature on the relationship between EHRs and improved healthcare quality beginning with the theoretical framework adopting the 1989 Fred D. Davis’ Technology Acceptance Model (TAM). The TAM shows the relevance of the connectivity between EHRs and quality of care. The chapter is further reviewed empirically and breaks the literature into themes based on the study objectives thus; the use of EHRs which showed the various ways EHRs is used in health facilities; behavioral intent to use EHRs, which expands the will to use the system and some controversies on the system and then the impact of EHRs on quality of care, which shows evidences of the benefits presented by the system on the quality of care. It shortly reviews some relevant other literatures then ends with the conceptualize framework on the connection between EHRs and improved healthcare quality.

### **Theoretical Framework**

#### **Technology Acceptance Model (Tam)**

Fred D. Davis in 1989 launched the Technology Acceptance Model in his research study entitled "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of IT which is summarized in figure 2 below." The fundamental objective of the theory outlines the factors that impacts the acceptance of technologies of self-service. Davis implored that, the model assists practitioners and researchers to identify the reason for unacceptability of a certain system. Davis starts his model on the premise that the real use of the technology, defined as "one particular conduct of concern conducted by people with respect to certain data technology scheme" is influenced directly by behavioral intent to use, which he also calls “acceptance”, normative and control believe. Behavioral intent is defined as “an individual's motivation or willingness to exert effort to perform the targeted behavior” [27]. The TAM theory is based on reasoned action theory which is aimed at explaining the behavior and connecting two main predictors, thus convenience of usage and useful and dependent variables. The theory further opined that, utilizing a system of information is openly measured by the intention of using it, then affected by the attitudes of the users to usage of that system and apparent system usefulness [28]. Usefulness and attitude tend to be affected by apparent convenience [29]. According to Kithaka the theory contends that the acceptance of individuals to a fresh technology is measured by two technology perceptions, thus perceived convenience of system usage and perceived system usefulness (2014:20). Perceived convenience of usage can as well instrumentally contribute to enhancing the performance of a person due to the reality that a user is going to have to use less energy with a tool, which is convenient to employ, he is going to have the capacity of sparing efforts to achieve other jobs [30]. This theory is relevant to the study because the acceptance and behavioral intent to us affects the impact Electronic Health Records System has on quality of care in the health sector which is vital in transforming the phase of healthcare across the globe. Again, the TAM theory is adopted because it sought to connect the

usability and its connections to enhancing quality is in agreement to the main objectives of the study as will serve as a theory to evaluate the impact of EHRs on quality healthcare at Asamankese Government hospital with the ultimate goal of measuring the quality of care using the Hospital's method, structure and outcome of EHRs.

### Perceived Usefulness (PU)

The extent to which one believes their work performance can be raised by using the Electronic Health Record system, for example whether the system can help them to finish their work faster.

### Perceived Ease of Use (Pea)

The degree to which healthcare workers need to use a mental and physical effort (after being trained on how to use and the services it renders) to use the EHRs in their facility.

### Behavioral Intent to Use/Usage (Acceptance)

The perception of the ease to use and usefulness of the EHRs and the understanding of a changing to the digital aged as well as the idea of using the electronic means of keeping medical records affects the acceptance and the intention of healthcare workers to use the EHRs.

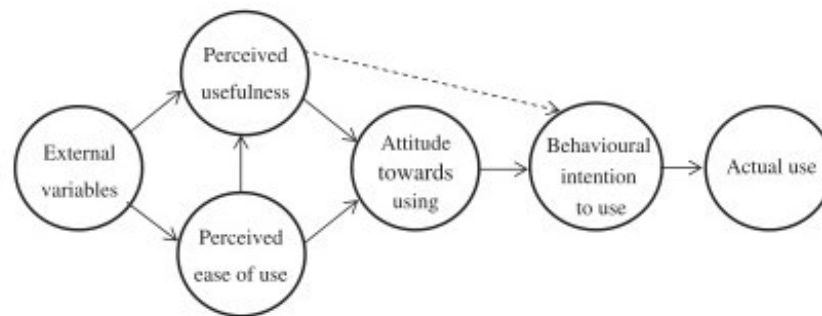


Figure 2: Technology acceptance model.

Source Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, 35(8), 982-1003.

### Empirical Review of EHRS and Its Impact on Healthcare Quality

Piette et al indicated that electronic health information system usage varies widely in developed nations thus, it is used for nearly all primary care patients in Denmark, the Netherlands, Sweden and the United Kingdom of Great Britain and Northern Ireland, but for less than 20% of such patients in the United States but unfortunately most developing nations like Ghana are still in the process of implementing it (2012:366). Mtebe and Nakaka argued that hospitals in sub-Saharan Africa countries have been investing heavily in electronic medical records (EMR) systems recently with the aim of improving patient safety, healthcare quality, and transforming the healthcare industry (2018:1). It is worth noting that healthcare system generates data, exchanges and stores large amounts of patients' data/information in electronic health records system and databases, as well as able to analyze and discover in some cases emerging genome sequence data and vast amounts of information relevant for future use. EHRs enable hospitals to store and retrieve these data and detailed patient information to be used by health care providers, and sometimes patients, during a patient's hospitalization over time, and across care settings and are effective in healthcare service delivery as it promoted easy sharing of information, promotes transparency and time serving, ensured security of information, proper data management, promotes customer satisfaction and enhance efficiency. Tumbo proved in her studies that

EHRs ensured security of information, proper data management, promotes customer satisfaction and enhance efficiency (2020:45). The implementation of the EHR system reduces cost, increases revenues of the hospital by ensuring timely and accurate capture of charges for medications, medical supplies, provision of clinical services, enabling reduction in the expenditure on paper-based logistics, enhances the retrieval of bills owed by patients who leaves without settling medical bills whenever they return to the facility and reduces the workload of staff. Embedded clinical decision support and other tools have the potential to help clinicians provide efficient and effective care than those using paper-based systems [31]. EHRs reduces patients' missing records particularly leading to the general improvement in the management of record-keeping with patient data becoming easy to identify as a result of the special coding system offered by the EHR system. Clearly, the implementation of EHRs improves access to precise and up-to-date health records of clients. The use of EHRs leads to more efficient, safer, and higher quality care, which is a positive effect in healthcare. Miotto, Kidd and Dudley in their work on deep patient: an unsupervised representation to predict the future of patients from the electronic health records, argues that we are currently on the edge of a golden era of medical understanding with the amount of available information to support healthcare increasing at an enormous pace (2016:8). Poon et al indicated that primary care physicians connected the use of particular EHR characteristics with improved healthcare quality (2010:1698-1707). This brings to bare the need for entities who are in charge of healthcare in Ghana and other African nations to concentrate on enhancing the implementation of robust EHRs and improving the use of particular characteris-

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tics rather than merely deploying EHRs in order to maximize the quality of health care. All these reviews show the evidence that the introduction of EHRs enhances health care service delivery which will now be broken down into the various objectives of this study.

### **The Use of EHRs in a Health Facility**

The first objective seeks to review literature on the adoption, implementation and usefulness of the EHRs among both staff and patients. The Electronic Health Record system can be useful in many ways for both patients, healthcare workers and facility management team. The EHRs is used to capture, store and analyze clinical data of patient right from the records department to the last point of care of clients before departure even including the morgue. Its operation entails care of patients since it operates as a core information source for communication amongst healthcare providers, handling the history of the patients, observing, diagnosing and the therapeutic conclusions as well as a broad range of unstructured information and documents [32]. The investigative arm of EHRs helps clinicians to easily request, view, analyze and interpretation client's laboratory and radiological investigations with ease. EHRs is employed for controlling and managing reports, test outcomes, standards, instruments, samples, and automations of workflow and the upload of results for clinicians to view [33]. Also, the prescription arm helps clinicians to prescribed rightly thereby reducing errors and misinformation. Therefore, any person authorized can be involved in tracking a drug and make the necessary corrections at any period of time and may get to see the amount of inventory left for a day [34]. EHR reduces the task of the pharmacy by aiding in the costing or billing of patients' drugs, makes it easier to track expenses owed to the facility by virtue of the health service provided to the patient and help in administrative processes and report [35]. Finally, EHRs is used in the general management of the hospital such as procurements, financial accounting and billing, generating reports from various departments, monitoring and evaluating of the facility's performance.

### **Behavioral Intent on the Use of EHR (Acceptance)**

This analyses the acceptability of the electronic health record system by staff and patients and their intention and enthusiasm to use it. The intent for using EHRs is a key part of the success of the system because psychologically, the user may not utilize a system where he or she doesn't have the intent to use already [36]. Nkansah indicated that the introduction of EHRs in both developed and developing countries can face certain challenges such as resistance of certain medical and health professionals who are used to the paper-based system as well as others having mixed feeling about the sustainability of the EHRs due to its sophisticated nature and its associated requirements such as internet connectivity, skilled labour/training of staffs and frequent maintenance (2019:52). However, WHO stated that, moany health administrators and hospital managers understand that it will take some time for most health professionals who are used to the paper-base system to adjust and show positive intent to the use of the EHR (2006:9). Nkansah revealed that some health practitioners expressed the need for the

EHR system to be continued since it is increasing client's satisfaction (2019:52). Addo & Agyepong indicated that healthcare professionals provided positive feedback concerning quality improvement of health services since the implementation of EHRs in their health facility as well as proved that the system benefited their hospital the paper-based system hence their acceptance of EHRs. Therefore the perceived utility and perceived ease of use resulted in increased behavioural intent to use the EHRs.

(2020:44). this underscores the view that although the full implementation of the EHRs has some challenges, there is widespread acceptance of its use due to its potential benefits of improved healthcare quality.

### **Impact of EHR on Healthcare Quality**

We review various literature and study on the perceived benefits and impact of the EHR system on the quality of healthcare delivery. Quality of care is the degree to which health facilities for individuals and people improve the probability of required health results (quality principles) [37]. Indicated that, when the system design is poor and improper can cause errors that jeopardize the integrity of the information, leading to errors that endanger patient safety or decrease the quality of care, which was in agreement. These draw backs do not impede the impact of electronic health record system on healthcare quality since there are millions or literature proving its successes especially in Africa. Therefore, to achieve the high-level quality of care and improved patient safety anticipated from the use of EHRs, the above problems need to be addressed [38]. Indicated that the use of EHRs leads to more efficient, safer and higher quality of care. Majority of care providers believes the use of ICT resources in healthcare facilities increase the quality of healthcare again proved in their study that majority of respondents agreed that ICT enhances doctor-patient rapport and improves quality of health care delivery as well as 56% of respondents agreed to the fact that using ICT in healthcare provides quicker access to medical diagnosis [39]. ICT integrated system has enhanced reduction of medical errors which goes a long way to holistically improve quality healthcare outcomes supported this by evidently proving in their study that hospital-treated patients with complete EHRs have a reduced mortality rate (3.7%) than patients (4.0%) treated with partial use of EHR or no EHR (4.4%) treated in hospital. Also patients treated in hospitals with complete EHR have a distinct statistically important readmission frequency (19.4%) compared to patients treated with partial EHR (19.6%) or no EHR (20.3%). These means it can reduce medical errors and reduce overall healthcare costs and improved medical documentation and support systems for clinical decision-making which adversely improves healthcare quality. The use of the EHR improves personal healthcare of clients (Nkansah 2019:39). EHRs promotes easy sharing of information, transparency and time serving, ensured security of information, proper data management, promotes customer satisfaction and enhance efficiency [40]. Furthermore, EHRs' improves Out-patient department care delivery by ensuring that proper triaging is done and as well is able to arrange patients

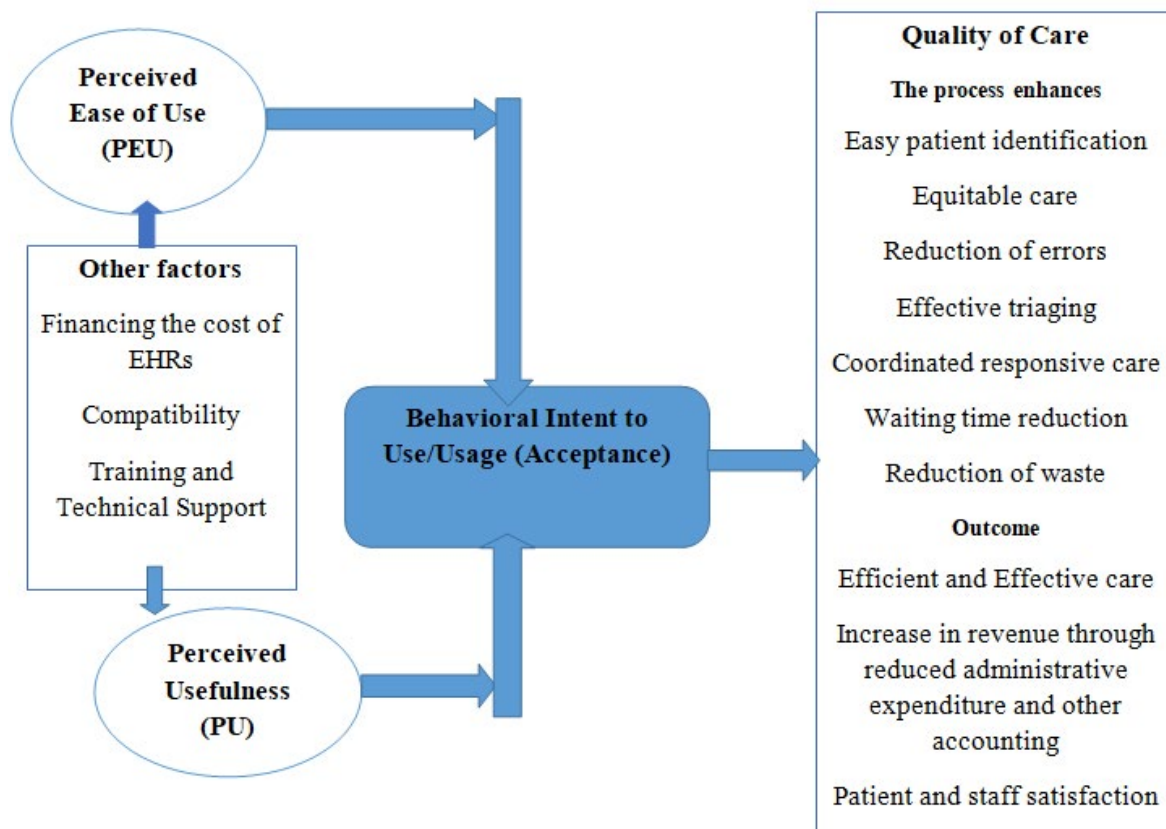


in order of the time they arrived at the clinic and the consulting room they are supposed to be seen. The findings of Nkansah indicated that the EHR system improves triaging, reduces discrimination, reduces waiting times and improved clients' satisfaction (2019:54). Clearly, it can be said that, the EHRs presents a lot of benefits to both users and healthcare managers such as, reduction of waste, reduction of waiting time and harmful delays, respectful and responsive healthcare delivery, reduction of various harm to patient due to medical errors and improved appointment booking and improved healthcare outcomes. Also, EHR system enhances the delivery of responsive healthcare to clients as well as ensuring all clinical decisions are guided by client-centered values. Finally, one headache of hospital managements in the paper-based system was the issue of missing documents as well as long search for the folders of patients. However, EHRs brings massive improvement in record keeping meaning, there would no missing folder or laboratory report as well as curbing the long search for client's folder. Silow-Carrol, Edward and Rodin indicated that, electronic health information management system enable hospitals to store and retrieve detailed patient information to be used by health care providers, and sometimes patients, during a patient's hospitalization, over time, and across care settings (2012:1). Also, Nkansah re-

vealed that management of health facilities benefit a lot from the EHR system through that quality of patients' records, attending to patients simultaneously, quality requisitions, faster and easier booking of appointment among others (2019:53). Health information technology is anticipated to assist improve health professionals' efficiency, decrease operational/administrative expenses and improve patient safety when the EHR system is designed and used properly.

### Conceptual Framework

Shikalepo concluded that the conceptual framework is an overall comprehensive presentation of the main ideas raised in the literature sources and theories reviewed (2020:5). This is a special aspect of the study in which the relationship between the main variables of the study objects is analytically presented in a diagram/pictorial form. A conceptual framework is a synopsis of various findings from the literature sources that have been reviewed about the research, setting out the research agenda for increased understanding of the research intentions [41]. Figure 3 (conceptual framework) summaries and merges the key points or findings of the review, into one unit with a common literature position that can easily be understood.



**Figure 3:** Conceptual framework. Source: Author's construct. (2022)

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### Areas of Controversy on the Use of EHRs

Ben Walker in 2021 mentioned the issues of confidentiality and privacy has been a subject of controversy in the use of electronic health system. The openness of EHRs makes it difficult to ensure privacy and confidentiality as both clinical and non-clinical have password access to the system which can be used to retrieve data of others they are not supposed to see. Again, Addo & Agyepong stated that, many of the health care professionals lack the requisite knowledge and skills in the use of ICT as well as lack of proper training and lack of ICT infrastructure could impede the impact of ICT in quality service delivery (2020:35, 45). Network issues and electricity instability sometimes affect the smooth operation of the EHR system. The issue of hacking hospital database to steal medical records of some clients have emerged. Hospitals therefore must vary a well encrypted and protect server and database to curtail this.

### Gap Filled By Study

Many of the above reviewed literature highlighted more on the uses of ICT in health, implementations and adoption of electronic health record system in health facilities across the world. Particularly in Ghana, less literature is found on electronic health record system most especially on its impact/benefits on healthcare in the country. Although the current research study delves deep into the electronic health records system of the Asamankese Government hospital and its impact on healthcare quality, it is meant to fill the big gap in literature concerning EHRs in Ghana. Again, it gives a qualitative view on the importance EHRs in the health system of Ghana thereby filling the literature gap on proves of positive impacts on quality.

### Summary

The chapter reviewed literatures which were specifically connecting the connection between electronic health system and quality of care. It adopted the Fred D. Davis (1989) Technology Acceptance Model (TAM) to expand the connectivity between information technology and benefits such as improved healthcare quality. The chapter was further broken down based on the study objectives to review previous literatures that were in consonance to the study and then a conceptual framework was formulated to underscore the connection of EHRs and healthcare quality. The various literature indicated the existence of a relationship between electronic health records system and healthcare quality. Despite the fact that this literature has contributed greatly in understanding of EHRs especially in Ghana, most focused on the adoption of the system and the challenges faced with literature on the electronic health records impact on healthcare quality appearing to be uncommon. This makes it imperative that, this study will bring a new light to the EHRs and add to the inventory of data relevant to electronic health records system. The next chapter discusses the methodology used for the study, justifying why the qualitative design was appropriate and its relevance to the study, sample size and its sampling method/techniques among others.

## Chapter Three – Methods

### Introduction

The chapter explains research methodology considering why the study chose the qualitative approach over others. It gives a brief history and services rendered by the research setting. It also discusses the case study design which affords the researcher the needed impetus to choose the sampling technique/size, the study population, and the data collection instruments used. The sources of data, its validity/reliability as well as key constraints to this study and the ethical consideration were not left out.

### Study Setting

Asamankese Government Hospital, established in 1959 is a Ghana Health Service (GHS) facility providing general consultation services, emergency, general surgical and in-patient services, ophthalmology, maternal and child health, laboratory and radiological services, mortuary services, etc. to many communities in and beyond Asamankese in the Eastern region of Ghana. It has 118-bed capacity with average bed occupancy rate of 61.67 and average Out-patients attendance of 164 per day for the year 2021 serving several communities within the West Akim Municipality and beyond with over 200 staffs. It is accredited by the National Health Insurance Scheme (Asamankese Government Hospital health information Unit 2022).

### Research Approach

According to Goundar both qualitative and quantitative research approach have their variable features and benefits when chosen for a particular research study (2012:9-15). Quantitative research is based on the measurement of quantity or amount thus expressing or describing in terms of one or more quantities employing tools like questionnaires or surveys, time studies, etc. to achieve its objectives whereas qualitative research is concerned with qualitative phenomenon which is non-numerical, descriptive, applies reasoning and uses words and aims to get the meaning, feeling and describe the situations (Goundar 2012:9). Knowing the current study sort to measure the connection between EHRs and quality healthcare, an approach which is non-numerical and allows respondents to freely express their opinions without prejudice had to be chosen hence qualitative approach was more appropriate. The qualitative approach deals with quality correlation, describes how and why there is a connection between the EHRs and gives much more details to the researcher on the study. Qualitative methodology depends subjectively on observations and description to assess knowledge, attitudes, behaviors, and opinions of people and how variables inter-relates with others [42]. Stoop and Berg describes qualitative methods as “optimally suited to understand a phenomenon from the points of view of the participants and in its particular social and institutional context” (2003:463). It has the tendency of letting study subjects apply reasoning and express their feeling, understanding and the correlation between two variables in words to a given situation or topic this study lays direct emphasis on users’ experience and the interaction of context to ascertain the relationship between EHRs and improved quality of care. The qual-

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itative approach made it easier to understand the complex issues underlying the study phenomenon, allowing certain modification to be made to the study and giving room for unpredicted findings obtained from the study to be inputted into the study framework.

### **Design**

The research design is the general plan of how a researcher will go about answering research question [43]. There are many types of designs such as experiments, surveys, action research, etc. but the case study design was adopted. Robson defines case study as ‘a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple sources of evidence’ (2002:178). The case study was chosen above other designs since it goes very well with qualitative analysis and had the potential of arming the researcher to thoroughly study the impact of EHRs on quality of care at the study site by enabling combination of different data sources (interviews, observations, etc.), to take subjective opinions of staffs and clients using the electronic health records. Again, case study design is more appropriate in studying a single entity like a hospital to evidently ascertain a connection between a phenomenon’s. Also, it was chosen above others because it afforded considerable ability to generate answers to the question ‘why?’ the ‘what?’ and ‘how?’ questions, using various data collection techniques singularly or in combination [44].

### **Study Population**

The study population is the people which the researcher wants to study and generalize the study findings on. It consists of all cases of individuals or elements that fit a certain specification [45]. The study population involved patients, management and staffs who uses the electronic health record system in the Asamankese Government hospital.

### **Sample Size/Technique**

Sample size and the technique used are influenced by the availability of resources, in particular financial support and time available to select the sample and to collect and analyze the data. The sample size represents the specific people the researcher intends to seek their opinions, understanding and experience on the current study. Smaller samples sizes are used in qualitative research so far as the selected are homogenous and possess experience to give the requisite information to enable subsequent statistical analyses to be undertaken. The study sample size was thirteen (13) which were determined by the principle of saturation including one physician, one physician assistant, a record officer, a laboratory technician, EHRs manager, a pharmacist, two nurses and five patients. The researcher adopted the principle of saturation to reduce repetitiveness of respondents’ responses and also used a purposive and convenient non-probability sampling techniques based on respondents demographic and user experience of EHRs, which provided the opportunity to reach difficult-to-identify members of the study population.

### **Data Collection Instruments**

Data was gathered mainly through a semi-structured interview questionnaire which included 10 open-ended questions derived through the review of literatures on EHRs and quality of care taking into account the TAM theory. The questionnaire was drafted to assess the opinions, experiences of the EHRs and its relationship with improved healthcare quality of respondents. This approach helped researcher gather the best of data to make meaningful interpretation of findings and to validate the responses from the respondents.

### **Sources of Data**

Data were acquired from primary sources, thus from field observation as well as a guided interviews with management, staffs and patients. Secondary data sources abstained from books, internet, previous scientific studies as well as other journals were basically used for an empirical literature review which served as a guide for the study.

### **Data Analysis**

Robson iterated that, qualitative data analysis requires the “clear thinking on the part of the analyst” so as to make meaningful and useful presentation of the data gathered (2011:468). This is important since it involves the analyzing of words in the form of narratives or accounts. Again, qualitative data analysis is enriched by the ability to triangulate with observations and field notes [46]. The interview questionnaires were structured according to themes to reflect the study’s main objectives so as to aid easy analysis. The in-depth interviews were recorded using a voice recorder and played back at least three times whiles transcribing them into words under the various themes of the study so as to ensure the exact words of respondents are established leading quality and accuracy of responses. The content of the transcribed data, and observations were then analysed and interpreted based on the themes of the study.

### **Validity and Reliability**

In order to evaluate qualitative research, Creswell describes validation as a method to convey accurate findings through established validation strategies including: prolonged commitment and persistent observation, peer review or debriefing, negative case analysis, clarification of research bias; etc. (2013:244). The various chapters of the study together with including interview questionnaire were thoroughly reviewed by research supervisor who made the needed corrections and suggestions on the study to reduce biases before its approval. The investigator should recognize biases that may add to the study’s interpretations and conclusions [47]. Also, the researcher’s personal experiences working with EHRs and prior interactions with the hospital management and other respondents helped tackle the inevitable bias in order to better interpret the study findings. Reliability weighs extent to which a research instrument produces similar findings when it replicated ensuring consistency of responses [48]. Reliability in this study was ensured through piloting of interview questionnaire on

three potential respondents including a physician assistant and two patients. The integrity of the study was ensured as researcher responses of each participant were reviewed with them to prove the data captured was accurate and reflected the expected responses, making data gathered not only reliable but quality and credible.

### Ethical Consideration

Ethical consideration is an integral essential aspect of research which ensures researcher is granted the needed and free space to conduct a study and respondents are given the needed protection and their anonymity, confidentiality and avoiding deception. The identities of respondents remained confidential as they were adequately informed about the purpose of the study and their liberty to withdraw at any time. Since there was no separate ethical research committee in the facility, the research proposal was sent through the hospital administration and was approved by the hospital management.

### Limitation of the Study

The results of this study cannot be generalized to reflect other health facilities in Ghana, as it concentrated only on the staff and patients of Asamankese Government hospital. Secondly, since the study's objective concentrated more on structural, process and outcome factors ensuring improved healthcare quality with EHRs it did not investigate certain issues like negative attitude of staff towards its use, however, future researchers are encouraged to do further research in these areas. Also, the fear of being victimized due to their response made some respondents feel reluctant to give out information but the challenge was resolved as researcher assured them of maximum confidentiality as well as explained that although the study can help the facility to improve upon its services, it was purely for academic and scholarly purpose. Finally, some respondents especially clients went a bit overboard with their response by trying to chip in certain issues that were not related or relevant to the study, however the researcher used his experience to explain to such respondents how such issues can be channeled to authorities.

### Summary

The chapter discussed the methodology used in the study of relationship between EHRs and improved healthcare quality at the

Asamankese Government Hospital. It justified the selections of qualitative research and the case study design over others and proved how they were relevant in the study. It also justified participant selection, data collection techniques being mainly interviews and data analysis technique of the study. Finally, the chapter proved the validity of data gather, its limitations and the ethical considerations observed. This chapter links the study directly to the next chapter (four) where the findings of the data gather at the study setting, are analyzed and outcomes discussed extensively based on the themes of the study.

### Chapter Four – Findings / Analysis / Discussion

The previous chapter explained the research approach, data collections method as well as the sample sized used. The study used a semi-structured open-ended questionnaire to collect data from both clients and staffs of the Asamankese Government Hospital. This chapter presents the findings of the study, the analysis with its interpretations of the responses from participants and then discuss the results, then link it with previous studies to ascertain the impact of Electronic Health Records System on Quality Healthcare at Asamankese government hospital. The first part deals with the presentation of the findings from data gathered from the interviews, highlighting their opinions on the topic under study. This was done under various themes derived from the responses. The second part of this chapter analyzes and interprets in essence the findings from the interviews to present a clear picture of the data gather under various themes. The last section then discusses the findings under the study objectives and compares the current study and other studies that were discussed in the literature review to prove the relevance of the current study and then presents the limitations of the study.

### Results/Findings

#### Demographics

The demographic data of staff are presented with their codes in terms of their job positions, gender, work experience and their experience level with use of EHRs. That of the patients are presented with their codes in terms of their job, gender, age, number of years they have received care at the facility and their knowledge in information communication technology (ICT).

**Table 1: Summary of Staff Demographics**

Respondent	Job Title/Position	Gender	Work Experience	EHR Experience
ST001	Nurse	Female	3-5 years	3-5 years
ST002	Medical Laboratory Scientist	Male	6-10 years	3-5 years
ST003	Head of records department	Male	Over 10 years	3-5 years
ST004	Head of Pharmacist	Male	Over 10 years	6-10 years
ST005	IT/EHRs manager	Male	6-10 years	6-10 years
ST006	Physician Assistant (Clinical Psychiatrist)	Male	Over 10 years	3-5 years

ST007	Medical Officer	Male	3-5 years	3-5 years
ST008	Nurse	Female	3-5 years	3-5 years

Source: Fieldwork 2022

As shown in table 1, the 8 staffs who were interviewed had varied working experience ranging from three (3) to over ten (10) years with all respondents having at least three years working experience with EHRs. They include 2 nurses, a medical laboratory scientist, head of records department, head of pharmacy department, ICT/EHRs manager, a physician assistant who is also a clinical

psychiatrist and then a medical doctor. This shows that the respondents were from various departments of the hospital with different jobs descriptions as well as exemplifies their varied experience in their current jobs and the use of EHRs making them have the knowledge and experience to respond to the study in terms of their departments.

### Summary of Patients' Demographics

Respondent	Job Title/Position	Gender	Age	Years receiving care at the Hospital	IT Knowledge
P001	Student (3 <sup>rd</sup> year, SHS)	Male	18	3-5 years	Working skills
P002	Trader	Female	45	Less than 3 years	Beginner
P003	Farmer	Male	50	6-10 years	Beginner
P004	Teacher	Female	40	6-10 years	Working skills
P005	Banker	Female	36	6-10 years	Working skills

Source: Fieldwork 2022

As shown in table 2, the five (5) patients who were interviewed had varied IT experience with three having working skills and two beginners. This means majority of the clients have a fair idea of IT making them fit for the study. Three (3) of them have been receiving care at the facility between 6-10 years making them have the experience of both the paper-based system and EHRs. Finally, the different professions namely, banker, teacher, farmer, trader and student exemplify opinions of varied individuals with different economic status and literacy was sorted.

### Presentation of Summary of Interview Findings

The summary of the findings from the interview are presented in under themes below.

#### Responses from Staffs of Asamankese Government Hospital Implementation/Use of EHRs in the Hospital

The study found that all departments of the hospital use EHRs and all the departments of the hospital are fully electronic for about five (5 years now).

#### Willingness to Use EHRs

The study realized that all staff were happy and willing to use EHRs and wishes to continue using it.

#### Clients' Satisfaction of Services at the Facility through Ehrs

The study realized that, all five respondents were happy and satisfied with care delivery through EHRs and gave a high rating on EHRs use at the facility and wished its use continuous.

#### The Benefits of Using Ehr in Delivering Quality Care Provision of Care That Does Not Vary Because Of Personal Characteristics

The research found that, all the staffs interviewed except one had seen a positive impact with EHRs in terms non-discriminatory care, thus majority of respondents responded positively.

#### Avoidance of Waste, Including Waste of Equipment, Supplies, Ideas, and Energy

The study found that all responding staffs except one, thus majority of the respondents agreed and mentioned some positive impact of EHRs in terms of reducing/avoiding various wastage in the facility.

#### Effect on Waiting Time at the Pod

All the 5 interviewed clients agreed that the use of EHRs has aided in reduction of waiting time at the OPD although they had some few time issues at certain areas of the facility.

#### Provision of Responsive and Respectable Care to Clients

Here, the interview had a varied response from the respondents as three of the staffs agreed EHRs has improved their response to care and increased respect, whereas three thoughts otherwise and two had no comment on that. Also, three out of the five clients interviewed felt more respected with the EHRs care delivery whiles the rest were indifferent. This means, 6 out the 11 who responded representing the majority agreed EHRs has improved response to care and increased respect.

#### Impact on Triaging At the Pod

It was found that, three from the five interviewed clients represent-

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ing the majority have not seen any changes in triaging while two had positive opinions on that.

### **Reduction/Avoidance of Harm to Patients from the Care That Is Intended To Help Them**

For the reduction/avoidance of harm to clients, the study realized that, seven of the responding staffs representing majority gave a positive response on how EHRs has had an impact on it while one felt it has not done much since it sometimes rather led to harm.

### **Improved or Worsen Your Personalized Healthcare**

The study found that all 5 of the patients interviewed gave a positive response on how EHRs has improved their personalized care at the facility.

### **Appointment Booking At the Facility with EHRs**

While two out of five respondents had not booked appointment before, the three respondents were indifferent on EHRs changing appointment booking at the facility although two acknowledged that, EHRs may have had an indirect effect on it.

### **Impact on Cost of Healthcare at the Facility**

The study found that, four client's respondents, thus majority of them, saw no change with how much they paid for services rendered although two of them acknowledged EHRs has helped made the billing process easy and trustworthy while one respondent felt it has helped reduced his cost at the facility.

### **Healthcare Delivered With EHR Compare to the Paper-Based System**

All 5 client respondents felt EHRs is far better than the folder/paper-based system in terms of quality of care given

### **Healthcare Outcomes**

On healthcare outcome through the use of EHRs, seven out of the eight staffs, representing majority of the respondents agrees EHRs has had positive impact on healthcare outcome while one respondent didn't know out health outcome.

### **Challenges with EHRs**

The study found that, all the staffs who responded had at least one challenge with EHRs which they feel should be addressed and gave different opinions on that. Also, one client out of the five has not had any challenge so far with the EHRs while four respondents had a challenge. This means, majority of respondents had a challenge with the EHRs.

### **Analysis**

The thematic presentation using the triangulation method was employed to present the opinions of the respondents. The triangulation method helped researcher to validate the accuracy of the transcribed information and allowed for comparison of the responses to give a clearer indication of a closely related/similar and inter-connected opinions from the 13 respondents.

### **Fully Adoption and Utilization of EHRs at the Asamankese Government Hospital**

The findings showed that the hospital uses EHRs and is fully electronic in all departments. Some of the staffs had this to say: "Yes, we have been fully electronic since 2017 and it is really helping us". (ST003). "The OPD has been fully electronic for the past 5 years". (ST001).

### **Behavioral/Willingness Intent To Use EHRs**

The willingness of both patients and staffs were assessed to know if they wished EHRs use continues. The findings clearly prove all staffs and clients were happy and willing to continue using EHRs wholeheartedly. Here are some of their responses: "Yes, it needs to be continued since it is really having a positive impact in care". (ST007). "I always love to use it and so wish we continue to use it". (ST001)

### **EHRs and Improvement of Quality in Healthcare**

Staff and clients were asked 6 and 5 questions respectively in relations to improved quality with the use of EHRs. All respondents accepted EHRs has improved healthcare quality. Staffs and clients mentioned many benefits they have experienced with EHRs such as reducing discrimination, avoiding waste, reducing delays, positive healthcare outcome, etc. The findings prove that the use of EHRs has improved the hospital's records keeping of clients' data, making it easy for caregivers to retrieve previous information of clients with just a click on the computer. This has made caregiving easier and faster with less delays to both staffs and clients. Also, errors have reduced significantly especially on prescription of drugs as well as has helped in tracking the expiry dates of drugs. Furthermore, EHRs has improved triaging at the OPD and increased responsive care which has led to improvements in healthcare outcome at the Asamankese Government hospital. Again, the system is transparent to both clients and staff thereby reducing over billing and increasing clients' satisfaction on bills and care given. The various responses are broken down into many sub-themes.

### **Quality Improvement of Patients Records**

The findings prove EHRs has improved storage and retrieval of health data. EHRs has also solved the problem of missing clients' data such as health information and laboratory results. Some of the respondents testified as: "It is easier to search for previous results of clients with regards to years backward since all the records are kept on the hospitals' server. (Backdating to check previous results is much easier and faster)". (ST002). "When I forget to bring my card, the man at the records only asks for my phone number or NHIS card number to retrieve medical record and write my card number for me unlike previously which I would be required to do a new folder". (P003)

### **Attendance of Clients without Discrimination**

EHRs has improved equity in care and reduced discrimination among clients thereby enhancing first come, first serve. Some respondents had this to say: "EHRs has improved our 'first come

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first serve rule in the records department. Staff serve clients as they are seated in the queue without prejudice to gender, ethnicity, etc. but in emergency situation and when we see neonates, we make sure we serve them before others". (ST003). "I feel a lot more respected with the use of EHRs because there are less delays and people do not skip the line with no quarrels and shouts". (P001).

#### **Reduction of Harmful Delays and Improved Responsive Care**

The analysis found that, EHRs reduces waiting time of client, improves triaging and increased respect to clients and client centered values are placed above everything else. This has increases productivity, accuracy and efficiency, makes work faster, simpler thereby reducing certain harmful delays and increased staffs' responsiveness to care. Some respondents mentioned that: "It has positively affected our response to emergency. It helps us to quickly know clients' background and previous health history especially in emergencies so as to quickly offer a quick aid to them before any other things are done". (ST007). "Has really reduced the waiting time and everything is fast" (P004).

#### **Reduction of Harm to Patients**

The findings brought out that, EHRs has reduced medical and prescription errors which had the potential of causing harms that can negatively affect quality of care to clients. This has as well ensured the right patient receives the right kind of care and certain issues which used to cause harms to patients like missing laboratory report, giving the wrong report or folder to client or serving the wrong mediations have been kept in check. Some respondents had this to say: "About 8 years ago, I was once given wrong medication when my folder exchanged with someone with similar name. I noticed the drug given me was diabetics' drugs and so I prompted the dispenser who recognized the exchange and searched for my folder to give me the right drugs. I haven't had this issue again with the electronic system. I only drop my card at the service provider's place and then get served accordingly". (P005). "It has reduced prescription errors which used to be a problem in the folder system" (ST007).

#### **Reduction and Avoidance of waste**

Findings showed that, EHRs reduces waste of resources, money and drugs, also helps track expiry of drugs and other resources thereby saving facility money as well as increase efficiency of care. Here are opinions from some respondents: "It has avoided waste of our time and energy in scanning through a lot of folders in order to pick just one folder. At first, we have to spend a lot of minutes searching for the folder of clients and sometimes you get confused when you see client has two folders or the folder is finished and so an additional one must be attached. Some patients had bulky folders and I believe the doctors really suffered knowing their records. But with the EHRs very information about the clients is on the computer and they are safe there since without a password, no one would know what is in there and doctors only need to just click a bottom to view previous diagnosis of clients. I think it is saving the facility a lot of money". (ST003). "It has helped reduced wastage

by helping track the expiry dates of medicines thereby reducing drugs expiring". (ST004).

#### **Reduction in Healthcare Cost and Improved Appointment Booking**

The study found that, EHRs had less impact on appointment booking and healthcare of cost of clients, however, it has an indirectly effect on appointment booking as it makes the process a bit faster and the quality of billing/cost of care at the hospital as well increased client's satisfaction/trust of bills paid. Respondents had this to say: "it has reduced the money I pay. The computer bills me directly and so I don't think anyone can't cheat me like how I feel cheated whenever I go to a hospital using folder". (P002). "EHRs has made it easy and faster to book appointment here but it used to be similar with the folder too". (P004).

#### **Improved Healthcare Outcome**

An important measure of healthcare quality is the outcome of the care rendered to clients. Findings revealed that, EHRs undoubtedly has improved healthcare outcome such as reduced morbidity like convulsions at the OPD with clients testifying it has had a positive impact on their personal health. This means EHRs improves the personal health of clients and improve healthcare outcome. Here are some responses: "It has improved since all my personal records are on the computer and so the doctors know what I was treated for on my previous visits". (P004). "It has improved morbidities such as convulsions at the OPD since we are able to provide services faster than before especially in children". (ST003).

#### **User Satisfaction of EHRs**

The analysis found that, EHRs increases patients trust and satisfaction. Patients feel comfortable and satisfied with care given through EHRs. Hospitals using EHRs are likely to have higher patient turnout as patients are more likely to choose facilities using EHRs over facilities using the paper-based system. Here are some responses: "Very satisfied since it has made care seeking simple around here". (P004). "I always love to use it and so wish we continue to use it". (ST001).

#### **Challenges Associated With EHRs**

The study also found some challenges relating to the EHRs from both the patients and staffs. The staffs raised challenges with poor network, electrical instability, among others whiles the clients mentioned long waiting times when there is power outage or poor network. These are presented under 2 themes.

#### **Poor Internet Connectivity and Electrical Power Instability**

Poor internet connectivity and frequent power outages slows down the EHRs software leaving users frustrated and keeps patients waiting for long. This means poor internet connectivity and unstable electricity reduces the effectiveness of EHRs which can frustrate users. EHRs will be difficulty to function well at places with poor internet connectivity. Some respondents had this to say: "Poor network makes it difficult to retrieve patients' information".

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(ST006). “Once I waited for long when I accompanied a friend here because they said the network was down” (P005).

### **Other Challenges**

It was found that, Information Communication Technology (ICT) illiteracy affects the use of EHRs and so people without ICT skills will have difficulties using it. Also, inadequate training of users affects their productivity with EHRs. EHRs maybe a medium for breach of client privacy if the right systems are not put in place. Longer hours of using computers can affect the health especially the eyes of users and can affect the willingness of users to use EHRs. Some of the responses are as follows: “Again, I for one started having eye problems after prolonged looking of the computer which our eye specialist prescribed glasses for me and so I’m okay for now with it and since it is helping all of us, I wouldn’t say it’s much of an issue”. (ST003). “Also, inadequate training makes it difficult to use the system at the initial stages. I believe electronic devices needs maintenance and so may be costly”. (ST006). “Staff need to be computer literate to use the EHRs”. (ST004). “Patient’s privacy can be breeched since a third party could get hold of patient’s data”. (ST007).

### **Discussion**

This section discusses the findings from the analyzed data collected through the interviews under the three study objectives and connect/compare findings with other studies from the literature review.

### **The Use of Electronic Health Records System at Asamankese Government Hospital**

The first objective of the research was to study the implementation/adoption and the use of EHRs in the Asamankese Government hospital. The objective was analyzed using the thematic analysis of the response from both the staffs and clients of the hospital. The analysis from the response of the staffs proved that, all departments of the hospital including records, laboratory, pharmacy, etc., were using EHRs to keep data of clients and that all the department were fully electronic. This means the facility has fully adopted the EHRs and the system is the main medium of communicating client’s health data among all clinicians and staffs including records keeping, laboratory reports, drugs history, diagnosis, etc. [49, 50]. Again, the analysis shows that the hospital easily creates, manages and safely keep all health data through the use of EHRs. The findings also reinstate the fact that, hospitals and health facilities in Ghana and other sub-Saharan Africa countries are adopting and investing heavily in EHRs so as to improve patient safety, healthcare quality, and transforming the healthcare industry [51].

### **Behavioral Intent/ Willingness to use EHRs**

The second objective of the study aimed at assessing the willingness of both clients and staffs of the Asamankese Government to continue using the Electronic Health Records System. The analysis reviewed that, all the staffs of the hospital were happy with the use of EHRs as it makes work easier and faster than before with

all the clients acknowledging the quality improvement of EHRs and expressed their satisfactions and willingness to continue using the EHRs. This proves that health professionals showed positive attitude towards the use of the EHRs and are ever ready to continue using it since it is having a positive impact on clients and also improving their efficacy efficiency [52]. Again, the findings proves that healthcare workers are more likely to accept EHRs and other health innovations once it’s safe, yields positive results and improves the care of their clients. This finding also underscores the fact that, users are likely to use tools, equipment and systems that ensures their convenience as well as contributes to their effectiveness, efficiency, and efficacy and transforms their efforts into a meaningful result with less energy and times use [53]. Also, some respondents had mixed feelings concerning the EHRs including waiting time at certain department, electrical instability, etc. This finding brings to notice that due to the perceived benefits from users, some people may have a higher expectation of the EHRs and when such expectations are not met accordingly due to certain constrain, users may have mixed feeling about the use of EHRs regarding its sustainability. The above findings defeat the mindset that healthcare workers are highly likely to reject the use of new technologies they are not familiar with [54]. Finally, the findings affirmed that, the willingness of users to use EHRs is a key aspect of the success of the system since psychologically, the user may refuse its usage if he or she doesn’t have trust or has no intent.

### **Impact of EHRs on Healthcare Quality**

The third study objective was to evaluate the impact of EHR on quality of care among the hospital staffs and patients in Asamankese Government Hospital. This was measured by thematic analysis of the responses of the 13 respondents from various semi-structure questions on quality healthcare as well as giving respondents opportunity to express their opinions on any other benefits/quality impact they have enjoyed through the use of EHRs. The respondents enumerated many roles EHRs has had on quality improvement in services at the hospital. The study found that, EHRs has improved the quality of medical records keeping as every data of clients are kept on the EHRs software. This means medical records staffs do not have to comb through thousands of folders in search of the folder of clients. This also brings a stop to records staff reregistering clients when their folder or folder number is missing since even without the client’s hospital identity number, clients’ phone number or name or other demographic data can be used to search for their hospital identity number so their records can be retrieved. Again, findings prove that EHRs has brought an end to the issues of missing clients’ records such as medical history, laboratory report and other relevant information as every data of client is stored on the serve and can be easily retrieved at any time Furthermore this finding means clinical staffs can easily have access to the past medical history, previous diagnosis, previous medications/treatment and any other relevant information about a client with just a click on the computer aiding in easy continuity of care. The finding again shows that EHRs promotes easy sharing of clients’ information among clinical staff in a transparent manner



in less time which makes clinicians such as specialist know what had already been done for clients by their junior colleagues [55]. Also, the analysis found that EHRs ensured security of health data information. Since the EHRs is securely encrypted and each account holder has restricted access to certain areas with their unique username and password, the information of clients is secured and cannot be stolen by a lay person. Clients feel their information is safe with EHRs since all their records are on the system and so can be saved during emergencies. The study again found that, EHRs reduces waste of resources such as time, money and others. Staffs wouldn't have to go through many files for hours in order to retrieve laboratory report or other relevant health data. Through the use of EHRs, the healthcare facility saves a lot of money from procuring notebooks for recording clients' identity numbers and other information, folders, papers as well as other resources which came with the paper-based system which help reduce administrative and operational cost of the facility [56]. Again, the analysis found that EHRs improves the efficiency and productivity of staffs. Since there is less writing and movements with the use the EHRs, clinicians are able to deliver care services with less amount of time and effort. Again, the ease EHRs provides in care helps clinicians conserve more energy to effectively produce the best of care. Again, the study found that, EHRs has reduced waiting time and client centered values are placed above everything else. Again, the EHRs enhances the responsiveness of clinicians to care especially in emergencies as they would be able to quickly know the past history and relevant information about clients with less effort. The analysis found that, EHRs reduces various medical errors and improved the quality of drugs served. EHRs has certain features that prompts users whenever a perceived error is detected such as prescription errors. The EHRs software is able to support prescribers in drug dosing, route and the quantity to serve and it's able to detect and prompt the prescriber in case there is over prescription, overdosing and any other prescription errors. This ensures that clients receive the right medications at the right dose and frequency (Nkansah 2019:14, Acquah-Swanzy 2015:20). Also, the analysis found EHRs to be helpful in pharmacy management by helping track expiry of drugs. The EHRs gives pharmacy staffs the opportunity to input the expiry dates of drugs into the system and gives them reminders when a drug is near its expiry date as well as when a drug expires so that it is not served to clients without knowing. This also means that authorized people at the hospital pharmacy would be able to tract and make corrections in the system concern drugs thereby improving the quality delivery of pharmacy services [57]. The study also found that EHRs undoubtedly has improved healthcare outcome such as reduced morbidity like convulsions at the OPD and helped make clients better. The EHRs enhances nurses' ability to know which patient is at risk of immediate morbidity at the OPD as the nurse can easily check clients' previous diagnoses with just a click on the computer. Again, the triage features on EHRs software are able to group clients into the various codes of triaging based on their vitals and the short history taken at the history room by the OPD nurses thereby reducing a potential morbidity. The accuracy and safety EHRs bring to service providers

supports them to provide the best of services to clients with less errors which makes them get better with no harm caused them. The analysis also realized that EHRs ensures non-discrimination in care giving as it improves the use of first come, first serve care delivery as well as ensures the right patient receives the right kind of care without prejudice to economic status, religion, ethnicity, etc. [58]. EHRs helps service providers to deliver services at a faster rate in less time making clients spend less time waiting for services to be rendered [59]. This makes clients feel more respected and cared for since they realize their care givers are able to meet their needs in less times with efficacy. The analysis again found that EHRs doesn't directly reduce the cost of healthcare service but helps make billing easier, transparent and faster. The EHRs software automatically captures the cost of services rendered to clients with service providers knowing and being able to communicate to clients the cost of services to be rendered. The billing system makes clients spend less time at payment points as the system has already calculated the amount to be paid with client already in the known. Finally, one key finding was client satisfaction of services rendered through EHRs with clients rating the facility very high as clients feels safer with the use of EHRs. This proves that the introduction of EHRs has improved the personal health of patients thereby increasing their satisfaction levels. This means facilities using EHRs are likely to have a higher patient turnout than facilities using the paper-based system due to the higher client satisfaction level and testimonies on the use of the electronic health records system.

#### **Additional findings**

Although the study objectives were set to know the impact of EHRs on quality healthcare at the Asamankese Government Hospital, a strong theme that waved itself into the study was the various challenges and fears of both staff and clients faced with the use of EHRs which affected the smooth running of the electronic health records. The analysis found that breach of clients' privacy and confidentiality was a concern with the use of EHRs as certain users of electronic health system can breach the integrity of the therefore system managers of EHRs must ensures proper data protection and security measures are put in place. Again, the analysis found inadequate staff training on the use of EHRs and information communication technology illiteracy of some user as a threat to the system. Staff who lack basic skills in information communication technology have difficulty using the system. Also, when less effort is put in place to adequately equip staffs on the use of EHRs software, it reduces its effectiveness. Again, the analysis found proper maintenance of the EHRs system and its cost threatened the smooth implementation of EHRs since poor maintenance of EHRs equipment can compromise the system and impede its smooth running. Another challenge found from the analysis which was of paramount concern was poor electricity and unstable/poor internet connectivity. Frequent power outages at a health facility can reduce the effectiveness of the EHRs since the server and other equipment are powered with electricity. Again, the system require internet connectivity and so unstable and poor internet serves in a

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hospital makes the system slow. This finding means that, developing areas or countries with very poor internet connectivity and electrical stability would have difficulty implementing electronic health records system.

### **Limitations of the Study**

The study focused on the impact of electronic health records system at the Asamankese Government hospital with study samples that represented the views of users of the system at the facility therefore this study cannot be generalized as a representation of the impact EHRs is having on all health facilities in Ghana. Also, since a small sample size was used, the findings may not represent the general views of all users of EHRs at the Asamankese Government Hospital. The qualitative approach and the small sample size can also be a limitation as only few had the opportunity to participate in the study since there could have been more nuanced findings if a mixture of qualitative and quantitative approach was used to include more participants. Again, since staffs and clients were posed with questions concerning their experience and perceived impacts of EHRs on healthcare quality, there is a possibility of recall and confounding bias. The above limitation notwithstanding, the study was able to generate enough data to achieve its main objective of assessing and proving the impact of EHRs on quality healthcare at the Asamankese Government Hospital making the study credible and very helpful to EHRs literature.

### **Concluding Remarks**

Healthcare quality is a major important factor in the health sector with current stakeholders finding ways of improving the quality of healthcare delivery. One of the main headache healthcare stakeholders have had in the past that posed a major concern to quality is the management of client's records and data at various healthcare facility. The adoption and use of the electronic means of managing healthcare data has evolved over the years to solve this perennial headache and become the main source of data management in many health facilities across the world. As a result, a lot of studies have been done concerning the use, implementation and full adoption of Electronic Health Records System (EHRs) in the healthcare industry but little was known concerning the impact it has had on improving the quality of care at the various health facilities using it especially in Ghana. This study was therefore conducted at the Asamankese Government Hospital with the main objective of evaluating the impact of EHRs on quality healthcare at the facility. The study yielded a positive result proving to a larger extent that EHRs has helped improve quality care delivery at the Asamankese Government Hospital by exposing many positive impacts the EHRs has had on quality improvement. Although the use of EHRs faced some challenges such as unstable internet network slowing down the system on some occasions, electricity instability which can be frustrating as well as inadequate training of staffs, IT illiteracy and concerns with breach of privacy, which all can be improved to make the integrity of the system better, it did not defeat the far-reaching benefits of it. The key successes

in quality improvement choked through the EHRs on the part of the hospital staffs were, improvement in the storage and quality of medical records solving issues of missing records, easy retrieval of records by healthcare practitioners, reduction in administrative and operational cost, improvement in client in safety, improved staff productivity, efficiency, effectiveness of healthcare delivery, reduction of waste of resources and helping track expiry dates of medications as well as improved health outcomes while clients also enjoyed reduction of waiting time and harmful delays at the OPD, improvement in triaging and responsive care, improvement in non-discriminatory care, improved personal healthcare of clients, improved clients satisfaction on services rendered at the facility. The findings of the study confirm the results of other studies on the benefits of using EHRs and affirms the conceptual framework of the study as well as the Technology Acceptance Model (TAM) theory. The study therefore succeeds in filling the gap in literature concerning the impact of EHRs on quality care delivery in Ghana and the world as a whole.

### **Recommendations**

Based on the study findings, the following recommendations should be considered. Firstly, the study recommends that the management of the Asamankese Government hospital must take proactive steps in organizing in-service training and retraining of staffs on the use of the EHRs so as to enhance their skills and use of it to aid in the smooth running of the system. Also, the facility should put systems in place to maintain the tools used for EHRs such as computers, servers, etc. so as to avoid breakdown and help sustain the use of EHRs. Furthermore, the facility should put up a good institutional measure to maintain adequate privacy and security of clients' data. The study again recommends that, the Asamankese Government Hospital improve upon its electrical power supply especially by getting adequate alternative power source to sustain the EHRs whenever the national electrical power supply is cut off. The study further recommends all health organizations in Ghana take a cue from the numerous benefits of the EHRs and put measures in place to fully adopt it or sustain it in their facilities. The study again also recommends that the Ministry of Health, Ghana and its various stakeholders review its policy used in healthcare delivery and implement highly technological schemes such as the EHRs across healthcare facilities so as to improve upon the integrity and quality in healthcare delivery. The study also recommends that the current study be replicated in other healthcare facilities using the EHRs so as to assess the impacts the system is having on healthcare quality so as to amass more literature on the electronic health records system. Finally, the study recommends that since this study used the qualitative method, further studies on same subject using other research methods like the quantitative analysis or mixture of methods could be used to accommodate a bigger sample size so as to offer alternative findings to either support or dispute the current findings and also reveal the shortcoming is this study.

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## Declaration

Ethics approval and consent to participate: The study and all methods used was conducted in accordance with the strict regulation and guidelines of the International Telematic University, UNINETTUNO. The study was then approved and accepted by the University board after a successful defense. Also informed consent was obtained from the study institution through an official letter of permission from the the International Telematic University, UNINETTUNO. (Letter would be uploaded as supplementary file).

**Consent for publication:** Not applicable.

## Availability of Data and Material

The datasets generated and/or analyzed during the current study are available as Dataset Generated and Analyzed during the study and uploaded in the supplementary file section/repository.

## Competing Interests

The author declares that he has no competing interests in this section.

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## Authors' Contributions:

The manuscript was singularly authored by Frimpong Matthew Antwi. All authors read and approved the final manuscript.

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