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ADOPTING AN INTEGRATED ELECTRONIC PATIENT HEALTH RECORD SYSTEM IN THE PUBLIC HEALTHCARE: A CASE OF NIGERIA

Master's thesis

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INTEGREERITUD ELEKTROONILISE PATSIENDI TERVISEKONTROLLI SÜSTEEMI KASUTUSELEVÕTT ESMATASANDI TERVISHOIUS. NIGEERIA NÄITEL

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Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

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Abstract

Recordkeeping has been an instrumental aspect of healthcare delivery because without proper record (regardless of whether it is an electronic or paper-based system) it will difficult for a physician to deliver quality healthcare service to the patient, because these records of the patient are needed by the physician to make informed decisions. Effective recordkeeping support clinical decision making and care of the patient. Service delivery in healthcare is moving toward patient-centred care because of some of the change in consumer demand and the uptake of innovative service in most countries. Patient-centred care has been an important concept because of the promised benefit that it has for patient and user of healthcare service. The use of electronic health record has facilitated the effective and efficient delivery of healthcare service to an extent; however, these systems were focused solely on serving the medical institutions and practitioners and neglecting the patient (who are essential stakeholders in the process). Healthcare provider uses the information to diagnose and treat a patient, but once the patients leave the healthcare facility, they are responsible for their health. In today's parlance, patients are expected to know about their health and should be actively involved in their healthcare. Therefore, there is a need for a system that effectively engages the patient in the delivery process. This development has resulted in the rise of electronic patient health record; a system developed for the patient, that effectively manages medical records of the patient and also interactions between the patient and the medical institutions. Several scholars have postulated that PHR has a lot of promised benefits for the healthcare sector. These benefits range from patient empowerment, cost and time saving, continuity of care, etc. The goal of this thesis is to propose a electronic patient health record system for the Nigeria healthcare system.

Keyword: Patient health record, Patient-centred care, electronic health record, Recordkeeping.

This thesis is written in English and is 49 pages long, including 5 chapters, and 2 tables.

Annotatsioon

Integreeritud elektroonilise patsiendi terviseandmete süsteemi rakendamine esmatasandi meditsiinis Nigeeria juhtumi näitel.

Andmete töötlemine on olnud meditsiiniteenuse osutamisel olulise tähtsusega, kuivõrd ilma korraliku andmestikuta (sõltumata sellest, kas andmed on paberkandjal või elektroonilisel kujul) on raske kui mitte võimatu anda meedikul kvaliteetset arstiabi. Efektiivne andmete töötlemine toetab meditsiiniliste otsuste langetamist ja patsiendi ravi, lisaks on see tõenduspõhise meditsiini instrument. Meditsiiniteenuse osutamine liigub patsiendikeskse teenuse suunas, tulenevalt muudatustest nõudluses ja innovatiivsetest teenustest. Patsiendikeskne ravi on oluline kontseptsioon, mis lähtub eeldatavast kasust patsiendile ja raviteenuse tarbijale. Meditsiiniinfotehnoloogia ja e-tervise süsteemi kasutamine on teatud määral hõlbustanud efektiivset ja tõhusat raviteenuse osutamist – samas need süsteemid olid keskendunud ainult raviasutuste ja meedikute teenimisele, jättes kõrvale patsiendi kui protsessi olulise huvipoole.

Raviteenuse osutaja kasutab informatsiooni patsiendi raviks, ent pärast raviasutusest lahkumist vastutab patsient ise oma tervise eest. Tänapäevases kõnepruugis eeldatakse, et patsiendid on teadlikud oma tervisest ja on hõlmatud oma tervishoiu protsessi.

Seega on vajadus süsteemi järele, mis aktiivselt kaasab patsiendi teenuse osutamise protsessi. Sellest on johtunud elektroonilise patsiendi terviseandmete süsteemi (PHR) teke: s.o süsteem, mis haldab patsiendi terviseandmeid ning infovahetust patsiendi ja raviasutuste vahel. Mitmed teoreetikud on väitnud, et PHR pakub erinevaid hüvesid meditsiinisektori jaoks. Need hüved ulatuvad patsiendi mõjuvõimu suurendamisest kuni raha ja aja säästmiseni, ravi järjepidevuseni jms. Käesoleva töö eesmärk on pakkuda välja patsiendikeskne elektrooniline terviseandmete süsteem Nigeeria meditsiinisüsteemi jaoks.

Võtmesõnad: patsiendi terviseandmed, patsiendikeskne raviteenus, elektroonilised terviseandmed, dokumendihaldus.

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 49 leheküljel, 5 peatükki, 2 tabelit.

List of abbreviations and terms

CCIT	Critical Creative Innovation Thinking
CCD	Continuity of Care Document
CCR	Continuity of Care Record
CDA	Clinical Document Architecture
CPC	Consumer Protection Council
EHR	Electronic health record
FMoH	Federal Ministry of Health
HIPAA	Health Protection Movability and Responsibility
HSRP	Health Sector Program
HITECH	Health Information Technology for Economic and Clinical Health
HIE	Health Information Exchange
HL7	Health Level Seven
ICT	Information and Communication Technology
IT	Information Technology
IDC	The International Data Corporations
IoT	Internet of Things
ISO	International Standards Organization
MU	Meaningful Use
NHS	National Health Service
PCC	Patient Cantered Care
PHR	Patient Health Record
PBoR	Patient Bill of Right
PIPEDIA	Personal Information Protection and Electronic Documents Act
WHO	World Health Organization
VoIP	Voice over Internet Protocol

Table of contents

List of Tables

1 Introduction

A country's healthcare delivery system relies upon how its healthcare facilities can deliver qualitative and affordable healthcare to its citizen. In this light, the role of the medical delivery system of a country can't be overemphasized (Ojo & Popoola, 2015). Health records are crucial for planning, development, and maintenance of an ideal healthcare system (Taiwo Adeleke et al., 2015). With the advancement in computing technology, various system has been adopted to maintain record electronically in the healthcare industry. One of such system is the electronic health record which has been utilized by most developing countries. The adoption of electronic health records enhance accessibility to patient data by healthcare providers during the healthcare delivery process which has potentially reduce medical errors and increase the quality of healthcare delivery.

Healthcare sector in Nigeria is currently embracing the utilization of information technology (IT); however, the electronic health record adoption rate in the healthcare delivery system is low. Most health division still utilizes the conventional paper-based system for storing patients' data in Nigeria. The paper-based system has been valuable for years; however, there is the need to adopt EHR to enable a better and dependable services from the healthcare providers. A report conducted by the Institute of Medicine (IOM) U.S estimated that 98,000 of U.S. patients die yearly because of preventable medical errors, this is because of the absence of access to complete and precise patient data (Sox & Woloshin, 2000). Additionally, resulting investigations have affirmed that inadequate information in U.S. medical facilities affects the quality of healthcare received by patients. If a similar survey was done in Nigeria, the results would have unquestionably been the same, if not worse because of the inadequate access of stored information by patients and healthcare providers. It is evident that electronic record has a lot of benefits for the healthcare providers. So, the focus of this thesis will be on electronic patient health record that enables the patient to own their data and get access to their medical records.

1.1 Problem Statement

Healthcare experts assemble comprehensive data on the patient; yet little of that data is shared with patients. In light of a legitimate concern for patient access to their health records, different enactment has been received worldwide for example, Europe's Information Security Directive, USA's Health Protection Movability and Responsibility Act (HIPAA), and the Nigerian Patient Bill of Rights (PBoR) developed by the Consumer Protection Council (CPC). With all these legislatures in place, it remains problematic for patients to access their health records since a copy of their health record is usually unavailable. Thus, it is difficult for them to control their health-related data and to be associated with decisions and management of their health.

The current EHR system in Nigeria is structured in a way that each healthcare facility keeps records of their registered patient which is only accessible to them. Despite the advancement of healthcare ICT and the adoption of EHR, there is little initiatives towards developing an EHR system that is interoperable and accessible to the healthcare user. Most of these systems are centered on healthcare providers. This study aims to explore the benefits of adopting a patient-centered electronic health record in Nigeria.

1.2 Definition of Terms

It is vital to make some clarifications in the use of terms in this thesis. Such explanations are required to help delineate the area of this study. First, I will differentiate between Electronic health record (EHR) and Personal Health Record (PHR) which can be confusing most times.

By definition, an electronic health record, or EHR, is an electronic version of the paper chart in clinician workplaces and hospitals. An EHR may incorporate the majority of the key administrative and clinical information about the patient under a specific health provider, for example information in the EHR are patient's demographics, medications, laboratory result, etc. On the other hand, the term patient health record can be applied to both paper or electronic record system that is maintained and developed for the personal use of the patient.

Electronic patient health records, or e-PHRs, contain comparative data as EHRs. However, they are intended to be created, maintained and safely overseen by patients. Data can emerge out from various sources, for example, providers, pharmacies, and even internet of things (IoT) gadget at home, and can incorporate, for example, diagnosis, prescriptions, family medical health history, and healthcare provider contact. From pieces of literature reviewed it is evident that the utilization of e-PHR can lessen medical blunders and increase the quality of healthcare service by enhancing the accessibility of health data. In this research the term "PHR" refers to both the electronic and paper-based patient health record, while the e-PHR refer to the electronic patient record. The focus of this study will be on the adoption of an e-PHR, an integrated e-PHR system to be specific.

Secondly, all through this thesis, the potential clients of the e-PHR system (i.e., proprietors of its content) are described with the terms "consumer," "individual," and "patient" these words are used interchangeably. It should be noted that the clients of the e-PHR system can be either sick or healthy. The term "health provider", "physician", "healthcare professionals", "doctors" is used to prefer to the provider of the healthcare service not the organization

1.3 Research Motivation

The advent of e-Health has resulted in an increased role attributed to information technology in the healthcare sector, and the increasing importance of patient-centered care (PCC) has required healthcare providers to deliver patient-centered service to the consumers. For instance, computer literate children of this generation, who make up a reasonable portion of the Nigeria population, are confronting health-related conditions as they age and are progressively looking for health-related data from different sources including the web. So, there is a requirement for an EHR system that enables access to health-related information to the patient. The e-PHR system as stated earlier is an innovative system that can facilitate patient involvement in the healthcare delivery process.

Various advantages have been proposed for patients using the e-PHR system. For instance, customers can get a wide range of health data by utilizing the access of e-PHR. The access to this information will expand their understanding of their health condition and be progressively increase engagement in their very own care process. The e-PHR

system enables consumers to manage and track their medical history effectively. By utilizing the control and access given by the e-PHR system, consumers can become empowered to manage their health. An example is patient easily identifying sickness at its early stage with the help of data available on the e-PHR system. They could also consult their doctors on any problem noted by the e-PHR system (e.g., a misunderstanding between current prescription and previous prescription).

1.4 Research Questions

The major objective of this research, to identify the challenges patients face with the existing PHR system and as well proposed the implementation of e-PHR system that improve the health information management for the patient in Nigeria. Hence to explore and attend to the research problem, the researcher has developed several research questions. The primary research question of this study is divided into three, and these primary research questions are further broken down into sub-questions which are highlighted below: -

Q1: How to examine the current state of patient health record system in Nigeria?

SQ1: What knowledge of patient health record system do the healthcare providers and patients in Nigeria have?

SQ2: What are the challenges of the current system to patient and healthcare providers?

Q2: How will the e-PHR system be adopted in Nigeria?

SQ1: What are the barriers and challenges inherent in adopting the e-PHR system?

SQ2: What is the most effective e-PHR architecture for the patient?

Q3: How to measure the effectiveness of adopting the proposed e-PHR system?

SQ1: What are the impacts of implementing the e-PHR system on healthcare delivery, patients and healthcare providers?

SQ2: What are the significant impacts of implementing the e-PHR system on the nation.

The first research question tends to identify the state of the existing patient health record system in Nigeria. This research question is divided into two sub-questions to gain in-depth knowledge of the current PHR system. The second research questions intend to examine issues relating to the adoption of the e-PHR in the Nigerian healthcare delivery system. Finally, the third question examines how to measure the effectiveness of adopting the e-PHR system; this is accomplished by identifying the benefits of the proposed system to patient, physician, healthcare delivery and the nation at large.

1.5 Research Objectives

This study aims to examine the challenges faced by the patient in accessing their health record in the Nigerian public healthcare and provide a system that appropriately attends to these problems. The study is guided by a set of objectives that direct the researcher's endeavors. The objectives of the research are enumerated below: -

- Examine the current challenges being faced by patients in accessing their personal record as a result of poor recordkeeping and an ineffective data exchange system.

- Give insights on how patient health record system can be improved using an e-PHR technology.

- Propose a suitable e-PHR architecture to guide the implementation of the e-PHR system.

- Identify the factors that hinder or promote the implementation and usability of the integrated electronic PHR system to be adopted.

- Examine how the use of this system in healthcare service delivery process will affect the key stakeholders and the healthcare delivery process.

1.6 Relevance of Study

As referenced before in this chapter, e-PHR system, especially the integrated type, have the potential of increasing consumer involvement in their care, along these lines enhancing their healthcare management and lessening the burden on healthcare providers. The e-PHR system helps provides quality and concise information for patient to make

better health decision. PHR system also substantially reduces long term medical cost for the patient.

Even though this researcher has selected Nigeria as his case, it is also important for other developing nations that have similar demographics and healthcare environment. The result of this research will help healthcare providers to get knowledge of the patient perspective in utilizing e-PHR systems. Healthcare providers will profit from the outcome of this research by having the capacity to deliver a higher quality of service at a lower cost to the patients through the use of the e-PHR system.

1.7 Outline of Thesis

This thesis is sectioned into five chapters. Chapter one (1) explores the current state of electronic records in Nigeria, introduces the problem under investigation, enumerates the research questions, presents the research objectives, and highlights the significance of the study.

Chapter two (2) offers a review of related works pertaining to recordkeeping. It further introduces the patient-centered care theory and the criticism of this theory. Furthermore, it provides a detailed explanation of e-PHR system and the factors to consider before implementing the e-PHR system.

Chapter three (3) of this thesis presents the research methodology selected, data collections method, data analysis techniques utilized to test the hypothesis of the study and validity procedures.

Chapter four (4) provide the background of the case, subject descriptions, and result discussions.

Chapter five (5) presents the conclusion and summary of findings, proposed an e-PHR architecture for adoption, presents the impact and implications of the research, limitation of the study, recommendations, and suggestions for future research.

2 Related Work

Prior to commencing a study, it is crucial to review the existing literature to get a concrete idea of the subject area. This section of the study provides a review of relevant literature and theories relating to the topic under study.

The chapter begins by reviewing several related works of literature and studies relating to recordkeeping and the two the major types currently used in Nigeria. It went further to introduce the theory of patient-centred and the criticism of this theory. Furthermore, the chapter introduces the e-PHR system and its key functionalities. It went further to explain the different architecture of electronic PHR. Finally, it ended by explaining the factors to consider before implementation the e-PHR system.

2.1 Recordkeeping in Healthcare

According to (Funmilola, Jinmisayo, & Ozichi, 2015) Recordkeeping in healthcare service delivery is vital as evident in the current evolvement of hospital record management as a core discipline in hospital management. Medical recordkeeping compromises all medical information both the charted and archived that is crucial in managing and increasing the healthcare service quality. As stated by (Reiser, 1991) The primary goal of patient recordkeeping is to recall observation, gain knowledge and effectively monitor performance. Recordkeeping in healthcare is a vital component in good professional practice and the delivery of quality healthcare. These stored records of the patient are essential for future reference because if these events are not stored, there is no evidence that they happened. However, "for the recordkeeping system to be useful, the system must be readily accessible and display information when needed to analyse and share them with relevant stakeholders who are directly or indirectly involved with the healthcare system." (Berg & Toussaint, 2003). Furthermore, recordkeeping ensures continuity of care. (Amos, Cockrell, Palermo, Rosehill, & Bearman, 2017) postulated that an effective means of keeping health records will aid continuity in healthcare and patient information security. Continuity is paramount to healthcare delivery, as many healthcare

professionals might be involved in treating a patient. Hence, there is need to transfer information so that healthcare providers can have a knowledge of the patient medical history to make informed decisions. Recordkeeping ensures that a proper and up-to-date record is kept which aid the dissemination of accurate and concise information to the healthcare professionals and will improve the quality of their decisions, and this is subsequently advantageous for the patient by reducing cost and time of repeating diagnosis and tests (Cucciniello, Lapsley, Nasi, & Pagliari, 2015). Recordkeeping effectively performed improves the coordination and reinforces decision making capacities of healthcare professionals, augment accountability of staff, and achieve more accurate vital patient statistics (Williams & Boren, 2008).

Currently, they are two types of recordkeeping system in healthcare facilities; which are the paper-based record system and the electronic health record system. In Nigeria, the paper-based record has been predominant in the public health sector as files are created for each patient that medical practitioners could use for recording their observations and plans so it could help them remember relevant details when they next diagnose the same patient. The traditional paper-based system has proved to be underwhelming as a result of the changing healthcare environment, information exchange demand among healthcare providers and the errors pertaining to handwritten notes (Chiang et al., 2013). "The paper-based system of recordkeeping relies on the handwriting of the medical health professionals, and so there is a possibility of the problem of illegibility of writing which can make it challenging to comprehend the information contained in the record." (Funmilola et al., 2015). Additionally, "An observational studies of physicians' use of the paper-based record find that logistical, organizational, and other practical limitations reduce the effectiveness of traditional records for storing and organizing an ever-increasing number of diverse data." (Tang & Mcdonald, 2006).

Furthermore, they are more challenges inherent in using the paper based record keeping system; such as insufficient physical space to keep patient files in the scenario where there is huge amount of registered patients and vulnerability to rodent and insect attacks, etc. Healthcare facilities that use the paper-based system have no sort of interoperability of patient information between them, because of this information are fragmented disrupting service, causing delay, and error in patient care (Overhage et al., 2002). In many cases, the patient might have to physically carry paper file from one unit in the healthcare facility to another (e.g., from the Health Maintenance Organization (HMO) office to the doctor's

office). This might give the patient access to information that might be confidential and meant for only healthcare professionals.

The shortcomings with the paper-based record have necessitated the handling of patient information digitally, which has resulted to the development of EHR. The EHR is the solution to most of the limitations of paper-based record. ISO define EHR "as a repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users. It contains retrospective, concurrent, and prospective information and its primary purpose are to support continuing, efficient and quality integrated healthcare." (ISO, 2005).

Thousands of published studies have recognized that electronic health record has the potential to improve efficiency, quality of care and patient safety. Therefore, electronic health record has been implemented by a lot of developed countries around the world. However, almost every EHR used in Nigeria have no option for patients to access their medical records.

Regardless of the form of recordkeeping used in the healthcare institution, patient in most cases do not have access to accurate and reliable information to partake in the healthcare delivery process. A study shows that patients who understand their health condition are more involved in the decision-making process with the doctor to effectively deal with their illness (Gustafson et al., 1998). To get the full benefit of an EHR system, it should be patient-centred, where the patient can own their data, monitor their health records and grant access to the medical institution that needs it (Detmer, Bloomrosen, Raymond, & Tang, 2008).

2.2 Theoretical Framework

"A trend has developed over a few decades that promotes the practice of healthcare that focuses on the needs of the patient." (Anderson & Funnell, 2010). Patient-centred care (PCC) is a move away from disease oriented care to a more participatory healthcare model by engaging the patient in shared decision making in the healthcare service delivery (Epstein, 2000). PCC has become a predominant concept in the medical industry. Before now, we have seen other industries, like the commerce adopting the concept of customer-focus or customer-centricity in designing, developing and selling their product to the

consumers. This concept has gradually moved into the medical industry in the form of PCC. Patient-centered care in healthcare is seen as service that is even with the patients values, needs, and this is achieved when clinicians incorporate patients in the healthcare delivery system (Mead & Bower, 2000). To buttress this point, (Stewart, 2001) postulated PCC ought to be defined in a way that attends to wishes of the healthcare users.

With the repositories of medical information available on the internet, patients are now empowered than ever before to research on their symptoms, medication, and diagnoses to get a better comprehension of their medical conditions and partake in the healthcare delivery process. The use of online platforms such as the pharma-sponsored WebMD tool has been essential to most patient as a means of obtaining health information. Patient knowledge of their health is beneficial for the patient and the medical institution. Thousands of medical errors will be seen and correct if the patient is knowledgeable and interested in their healthcare. The PCC will enable the patient to serve as a watchdog to the actions and inaction of the medical practitioner. PCC have been identified to have a lot of benefits and delivering better health service that increase patient satisfaction and reduces health cost. "Given the benefits inherent in PCC, mandate such as the World Health Organization's Global Strategy has increased awareness on people-centred care that empowers, educates, and engages individual and incorporate technology efficiently and effectively." (World Health Organization, 2015).

Technology has proved to be an enabler of the PCC concept. By the effective use of modern information system, various stakeholders in the healthcare industry can help develop the PCC to grow and expand. Technological tools such as patient portal and electronic patient health records have been used by the patient in developed countries to monitor and track their records effectively. Patient-centred care has received a noticeable amount of attention from healthcare providers in the healthcare industry. However, there have been critics of the patient-centred care; "some believed that putting too much power in the hands of the healthcare users who have little or no training to make informed decisions might be a problem" (Heidenreich, 2013). PCC is seen by most healthcare system as a way of improving patient satisfaction. However, is increasing patient satisfaction always translate to higher quality healthcare? Most medical institutions have made PCC their measure of quality in delivering healthcare service to the patient. Although, PCC is only one criterion for quality of care as explained by the IOM. Other important aspect includes safety, effectiveness, efficiency, and equity. In the pursuit of a

PCC approach, it is possible that other aspect of quality may suffer if there is no thorough mechanism with which the PCC is evaluated. There are cases where initiative aim at improving patient satisfaction may not always improve the health of the patient. A good example is a patient requesting for a dose of propofol to make him sleep and disregarding the health consequence of ingesting the drug (Heidenreich, 2013).

For medical practitioners to make an effective clinical decision, they need a proper evaluation of all PCC interventions, examining not just only the patient satisfaction with the care delivered but also their impact on the overall patient health and cost of delivering the service to the patient.

2.3 Evolution of Patient Centred Electronic Health Record

In 1994, the Guardian Angel "Manifesto" proposal envisioned the possibility of patient-focused information systems or electronic health records system where the web could oversee the managing of healthcare information and also give education and communication across the patient lifespan (Wetter, 2016). The internet era has facilitated the growth and availability of health information on the web, which consequently ensued the development of electronic patient health record system. Notwithstanding, with the advent of PCC there has been a need to develop a system that enables patient monitors and manage their medical history and maintain effective communication with healthcare providers. The health industry presumes the patient health record system and the patient portal are pivotal to the future of medical care and health management. Many researchers have seen that the e-PHR is a mechanism for involving patients to healthcare system and will directly empower in the healthcare delivery process; these will be beneficial for those with chronic ailment because they will need up-to-date and readily available information on their health status.

Recent studies show that there is an increasing amount of patient that are enthusiastic about the idea of managing their health record through electronic PHR. With this recent development, different developed countries have made the initiative to better involve the patient in the healthcare delivery process. An example is Australia launching a personally controlled EHR designed to satisfy the healthcare needs of patient, Estonia implemented a nationwide electronic health record system which gives full access to the citizen, The

United States has also advanced the HIE interoperability standards and patient policies to achieve similar goals.

2.4 Patient Health Record

The patient health record is not a novelty idea, before now some patient normally find means to store health data. What we presently allude to as patient health records (PHRs) emerged from the paper-based form of recordkeeping that patients have utilized for years since they needed a place to store and access their medical records effectively. The paper-based PHR can be files containing clinical data from different sources such as laboratory reports, prescriptions, etc. stored by the consumers. However, with advent of health information technology, the paper-based form has evolved to what we know today as an electronic patient health record system.

Electronic patient health record (e-PHR) system emerged as healthcare users started utilizing computer and word processing software and spreadsheet in storing and managing their medical data (Detmer et al. 2008). These records were normally used by the patient with chronic disease to track their health progress in order to effectively manage their conditions. Although, as the better data storage means became available (e.g. removable hard drive, micro drive, memory stick etc.), consumers started using these improved storage systems to save their healthcare data. Furthermore, the advancement of technology has seen the e-PHR system developed into a more sophisticated system.

There have been numerous definitions as to what e-PHR means by different scholars and medical institution, but for this study two definitions that elucidate the meaning of the e-PHR system. First, is the definition by the Markle Foundation and the Robert Woods Johnson Foundation which explains the e-PHR as:

"An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment." (Markle Foundation, 2003).

Another definition is one state Kaiser Permanente Institute for Health Policy (KPIHP). This definition explains the e-PHR can enumerated the common functionality exhibited

by all e-PHR systems. "While existing PHRs differ in functionality and the level of integration with other health information systems, they share several basic attributes:

• They allow individuals to manage their personal health information.
• The individual patient is the primary user.
• They contain information provided by the individual
• They are portable, meaning they can be accessed anytime, anywhere via the Internet, or carried with the individual in a digital media storage device
• They are tools for managing information relevant to lifelong health and wellness."

Kaiser Permanente as cited (Morris, Appsci, Dip, & Man, 2014).

These definitions give clarity to the wide-ranging discussion about e-PHRs. For this thesis, e-PHRs are electronic systems (either web or proprietor software) that a healthcare user utilizes to manage healthcare data and maintain communication with the healthcare provider. Most medical institution has realized that patient engagement in health service delivery is crucial in quality improvement and reduce healthcare cost. e-PHR has been viewed as a tool for the patient that facilitate patient participation in healthcare service delivery. Healthcare leader recognizes that e-PHR can be a means by which the consumers and healthcare provider are integrated and gain access to timely health information. Among these, e-PHR system could be gainful to encourage access and control of a patient's health-related data, yet in addition to advance self-administration of their health, enhance patient wellbeing, and improve productivity and adequacy of patient care

2.4.1 Key Functionalities of PHR

Most standalone e-PHR provides essential capabilities that are unique to all types of electronic patient health record system (Kim & Johnson, 2002). These functions include gathering, monitoring and storing of patient health data. Nonetheless, more advanced e-e-PHR, specifically the interoperable or integrated PHR offer robust functionality to the users of the system. Some of these advanced e-PHR have an interactive tool built in them which enables the patient to have control of their health information, uses decision support and have more effective and convenient interaction with the healthcare system. Some in-built functions in the e-PHR empower the patient to control access to their stored information. Healthcare users can likewise control the kind of data that every individual

is permitted to access, and also specify their privileges (which can be either read-only or both read and write access). To further secure the system, some PHR provides a monitoring scheme in the form of an audit trail that shows to the PHR owner the people who have had access to the system at a specific period.

2.5 Existing Architectures of Patient Health Record

Today they are different classification of e-PHR architecture done by various scholars and organization. However, in this study, there are three distinct types of electronic PHR system, which is: standalone e-PHR, integrated e-PHR and tethered e-PHR. The discrepancy between these systems is "who controls" and "owns" the patient data. In the standalone e-PHR, the patient has full control and ownership of his health information while with the tethered e-PHR the healthcare provider controls the patient data. The integrated e-PHR offers patient partial control over the system, it gives consumers control over some sections of the system because it is integrated with the providers EHR system

2.5.1 Standalone or Independent e-PHRs

The standalone e-PHR is typically a PC-based or paper-based system that is managed and updated by the healthcare user. Data entry in this system is done by the user (consumers) and the user have total control over accessibility of the system. By use of standalone system, the patient is able to access healthcare information using personal devices (e.g. laptop, phones, etc.). The key point is, the system is completely managed and controlled by the healthcare user. One advantages of the standalone e-PHR is that it allows the healthcare user to access healthcare information from anywhere and anytime and to share information with different healthcare providers when necessary without any restrictions. The primary disadvantage of this e-PHR is that there is incomplete integration between the system and the provider's system and it requires a form of manual data entry to input data, so healthcare provider might not trust the data provided by the standalone system. An early instance of standalone PHR was provided by Google. Google Health offered a web-based PHR, which demonstrated early signs of uptake, however, the system was discontinued in January 2012 as a result of the poor adoption by consumers (Brown, A., & Weihl, 2011)

2.5.2 Tethered e-PHRs

Tethered e-PHRs (which is often called the patient portals) is a restricted type of the integrated e-PHR that connected to a single healthcare provider EHR system. The tethered e-PHR system is an extension of the healthcare provider EHR to the patient, which offers patient access to part of the providers via the web. In this e-PHR system, data of the patient are managed by the healthcare providers, although the consumers can add information to some sections of the record. (Detmer, Bloomrosen, Raymond, & Tang, 2008; Kaiser Permanente, 2007) Kaiser Permanente's Internet-based e-PHR (kp.org) is a good example of a tethered e-PHR which provides the patient access to a range of functionality including booking appointment with healthcare provider, viewing laboratory results, secure communication with health professionals. The tethered e-PHR has a lot of benefits because it is mostly provided and managed by the healthcare provider, the system is closely linked with the clinical process and information in the provider's system. However, the inability of patient to manage and access to the information is the main disadvantage of the system. Furthermore, the tethered e-PHR doesn't give the patient the option of sharing information electronically with other healthcare service providers.

2.5.3 Integrated (non-tethered) e-PHRs

In the Integrated e-PHR, the patient information is gathered from various inputs, including provider's electronic record system, pharmaceutical data, and data from IoT and smart devices that provide healthcare user and healthcare providers with a concise health information. The healthcare user can enter data into the system and have some minor restrictions system. Integrated PHR enables the direct flow of information electronically from the healthcare provider EHR to the patient e-PHR. The integrated e-PHR can offer patient more control of their records as compared to the tethered e-PHR; The system attends to some shortcomings of the standalone and the tethered e-PHR; it eliminates manual re-entry of data since most of the data are gotten from different health databases, it facilitates an effective and secure communication between patient and provider and improves the quality of healthcare service.

Integrated PHR system can be seen to have a lot of promised benefits for the patient because it enables the patient to organize all his information from different sources in a

unified way. The system provides a knowledge base for the best practices for physician and self-care content for the patient via internet connectivity.

One disadvantage is that the safe and reliable transfer of data between the integrated e-PHR and other system largely depends on the data standards. Confusion about different data standards in different systems may lead to unforeseen and unwanted data errors (Bundgaard, 2014).An example of the integrated PHR is the Danish sundhed.dk offering patients to access medical information to help them manage their health.

Table 1: Comparison of attributes between the various electronic PHR architecture

	Electronic PHR architecture		
Attribute	Tethered	Integrated	Standalone
Complexity	Relative simple (conceptually)	High. Need to establish and maintain data source standards	Moderate: Network links to consumers, practitioners, etc.
Access	Portal or client server	Internet portal	Internet portal or Memory stick reader
Data Sources	Primary care server, pulling, data other sources (test labs, etc)	Pull Model: Central source, pulling from multiple primary sources. Push Model: Central sources, receiving data pushed from multiple primary sources	Network connections to consumer IDs that must be accommodated; Privacy controls may be lax
Major Risks	Access control by primary care physician or institution might be	Acceptance and maintenance of common standards	Loss or theft of device; Non-standards data

	too restrictive. Data entry by consumer may not be allowed. Transfer to other systems may be problematical	among data sources. Integration of networks and system requires high-level collaboration	sources and consumer IDs that must be accommodated; Privacy controls may be lax
Security	Secure extranet portal. Requires additional support beyond normal primary care server	Managed centrally with suitable levels of encryption and access control.	Accepted if encryption used.
Privacy	Managed by consumer's primary care site	Access managed through suitable levels of encryption and access control	Data controlled by the consumer
Example Installations or Trials	MyOscar	U.S. DVA	HealthVault

Note. Some modification was made to the original to suit this study. The table was adapted from Danish, Daglish., & Norm, Archer. (2009). *Electronic Personal Health Record Systems: A Brief Review of Privacy, Secuity, and Architectural Issues*. IEEE Xplore.

Each of the e-PHR architecture has its benefit and shortcomings to the user. In the means to propose the most beneficial e-PHR architecture to consumers, Table 1 has been adapted to compare the key attributes of all three e-PHR architecture. As depicted in the table, the security functionality of each system and the major risk associated with the system was outlined to give an overview of their capabilities.

2.5.4 Factors to Consider Before the Implementation of the System

Though there are promised benefit for the implementation of the system but as with all system implementations, they are some factors that needs to be considered to ascertain the feasibility and scope of the project. Below are some of the factors that needs to be considered by key stakeholders before the implementation of the e-PHR system.

- **The Changing Patient-Physician Relationship**

Though nowadays in healthcare delivery system, patients are involve as partners with the healthcare providers, the orthodox paternalistic model in medicine where healthcare provider sees the patient as someone who cannot and should not be involve the healthcare process might create a barrier to effective collaboration between the relevant stakeholders in the healthcare delivery process. This problem is a specific concern when a patient's choices are abrogated or disregarded by the clinician, or, then again, when the patient abuses the privilege to participate in the healthcare system. Hence, there need to be a balance of relationship between the patient and healthcare provider.

- **Scope of Responsibilities**

The utilization of electronic PHR has a lot of promised benefits to patients and physician as stated earlier in this study. But, various concerns about additional unremunerated responsibilities relating to the adoption of the e-PHR. With the already huge amount of clinical responsibilities for doctors because of the shortage in medical practitioner in proportion to the patients; medical practitioners may not have the time to explain the health-related data on the PHR system to the patient since some patient may need clarification on the medical data (i.e. medical terms and symptoms) to get a better understanding of their condition an effectively use the e-PHR system.

- **Trust of Healthcare User**

Consumer trust for the system is a hurdle to the adoption of e-PHR. Considering the recent breaches and attacks on health information system such as the WannaCry ransomware attack in the NHS which affect various hospitals in England and resulted in over 19,000 appointments being cancelled. According to a report from Telegraph UK, the attack locked access of 200,000 computers from authorized user. With this attack in mind, healthcare users will be sceptical about using a system that has the possibility of their information being compromised. Healthcare service consumers are interested in using the electronic patient health record to improve their healthcare. However, confidentiality and security their data remain an issue.

- **The Digital Divide**

The digital divide will largely affect the adoption of this system because they will be some users who can use the system and who cannot. This divide can be attributed to several factors such as socio-economic disparity of the Nigeria populace. In Nigeria, there is a wide gap between the rich and the poor. Some of the citizen may not see the benefits of using the system if implemented because of their financial standing. Health literacy and technology literacy among the consumers are major factors that will affect the implementation of this system. There is a huge chunk of the Nigerian population that is unable to read or operate a 21st computer, this set of people will require assistance and teaching which will in turn incur more cost on of the government. Furthermore, those with special needs like the blind and deaf will also require additional assistance in terms of individuals or better still a be-spoken e-PHR system that attends to their needs.

- **Return of Investment**

Health information system projects normally require a huge amount of initial investment. Stakeholders will want to ascertain the benefits of implementing as regards cost saving and healthcare quality improvement. Several surveys conducted have proved that consumer perceived that there are a lot of promised benefits inherent in using the e-PHR But, there is limited literature to scale the monetary benefits of the electronic e-PHR system. Even though there is a substantial number of consumers willing to use the system, it is not evident if these customers are willing to pay for the cost of using e-PHR system. Proposed benefits do not always translate to actualized benefits; a categorical example is evident in year 2009, when the US Congress passed the HighTech Act, proposing that by 2015 every America hospital should have an electronic medical record system. This initiative made a lot of hospitals in the US to implement the EHR. However, the system didn't leave up to expectation as a result of poor design and poor implementation of the software. The poor design was an oversight that made the system not to actualize the promised benefits to the relevant stakeholders. With this in mind, quantifying the benefit and return on investment will be very vital for those intended to fund the implementation of the project.

3 Research Methodology

In this chapter, the researcher begins by explaining the study design and method used. The following sections highlight the research question that help address the research problem, the case selected, and the sampling techniques that were used in the study. It went further to presents the methodology used for data collection and also clearly explained how the data was analysed. The chapter ends by describing the validity procedures.

3.1 Study Design

The study is a qualitative and naturalistic study that employs a case study which is designed to investigate the perceptions of consumers and healthcare professionals relating to the adoption of an e-PHR system. In this thesis, the work of Stake (1995) was employed as a guideline. Recruitment, effective sampling methods tailored interview for both consumers and healthcare providers, data analysis and interpretation were all techniques used to gather enough data to answer the research questions.

3.2 Methods

According to Stake (1994), the purpose of a case study is to examine a case to gain insight into the issue pertaining to the case. "A case study research examines a person, phenomenon, or any subject of analysis to extrapolate key themes and results that aids predict future trends, illuminate previously hidden issues that can be applied to practice or provide a means for understanding a significant problem" (Labaree, n.d.). In this research, the focus was to gain an insight into the perception of consumers and physician towards the adoption of the proposed system. A collective case study was utilized; the groups were consumers (either ill or healthy healthcare users) and the healthcare providers. The collective case study provided a different perspective from both groups that provide an in-depth understanding of the topic (1994). For the study, participant of

various age ranges was voluntarily sampled in both groups. The next section describes how the recruitment and sampling was undertaken.

3.3 Case and Subject Selection

The case selected is Nigeria, a developing country in West Africa that has been plagued with poor healthcare delivery. The case was selected because of the problems faced by the public healthcare delivery system of the country. This study can easily be generalized to other West African countries cause of the similarities the case shares with these countries. Additionally, another reason for the case selection was the familiarity and knowledge the researcher has of the case. The researcher selected a sample representing the population by picking participants from each geopolitical zone in Nigeria. More precise detail of the case is presented in the next chapter.

3.4 Sampling Techniques

The population studied were patient and doctors majorly from the public healthcare system from Nigeria. The sampling method used in qualitative research has an impact on the study outcome, considering this the researcher employs the convenience and snowball sampling techniques.

- **Snowball Sampling**

Snowball was chosen because of the few medical providers available and known to be the researcher. So, the researcher used referrals from a physician to get the next physician to be interviewed and so forth. With this method, we were able to get experienced healthcare providers with a good knowledge of the patient health record system in Nigeria.

- **Convenience sampling**

The author employed convenience sampling in selecting the user of the healthcare system. Convenience sampling is a non-probability sampling that uses participant close to the researcher. The researcher sample former co-worker, classmates and known associates in

a various part of Nigeria that have knowledge about the healthcare delivery system in Nigeria.

3.5 Data Collection Procedure

The reason for the qualitative research interview is to add to the body of knowledge that is conceptual and hypothetical. The qualitative research depends on the life experience of the respondent. The respondent is thus more a member in the meaning-making than a channel from which data is recovered (DiCicco-Bloom & Crabtree, 2006). Therefore, in this study participant were interviewed to get their opinions on the subject area. The face-to-face interview was not utilized cause of time and financial constraint; thus, telephone interviews were the primary source of empirical data collection. Different interview specimen was used to conduct the interviews between both groups; the two interview specimens are found in Appendix one (1) and (2). The telephone interview endured 20 minutes to 30 minutes. Healthcare users and providers were interviews to gain an insight into the feasibility of the proposed system and the benefits associated with it, a total of ten (10) healthcare users and five (5) healthcare providers were interviewed.

The interviews were recorded and open-ended to urge the respondents to share as much information as possible relating to the subject under study. Data collected lasted for a month, starting from 05 March 2019 and completing on 20 April 2019.

Before beginning the interviews, the participant was brief on what the interview entails and what was expected from them. The researcher ensures that each that the anonymity of each respondent is safeguard. All respondent was aware that the interview will be recorded and gave their permission. Although, some of the respondents were not in favour of the interview being recorded.

As a secondary data collection method, the researcher reviewed various document relating to the subject area. The materials reviewed involved online journals mostly from National Centre for Biotechnology Information (NCBI), blogs, online news source, research of other scholars relating to the subject area, etc. This approach provides the researcher with a better understanding and background of the topic and current trends with the proposed system.

3.6 Data Analysis and Procedure

After all interviews were recorded, the interviews were transcribed using a manual system, i.e., the researcher listened carefully to the audio and typed it verbatim word for word into a word processing software. Afterward, the transcripts were uploaded to RQDA (qualitative data analysis software) for coding. The data analysis process starts with the research familiarizing himself with the entire data corpus (that is all the audio interviews and transcripts) collected to get a general overview of the data. The researcher attentively listened to audio recording, read and re-read transcript to become aware of key concepts and recurrent themes. The researcher went further to code the data in a meaningful and systematic way. There is various method of coding, but the researcher makes use of a theoretical thematic analysis which codes each segment of the text according to its relevance to the research questions. The author also used open coding for the analysis, which means there were no pre-established codes, all the codes were developed and modified during the coding process. The codes were further compared to create more codes.

Furthermore, the codes were classified into themes whereby each code can be part of one or more themes. The themes were further reviewed to ascertain if they made sense to the researcher. Finally, the themes were refined to see the relationships between the main themes and sub-themes, and how the themes relate to each other.

3.7 Validity Procedure

Rigor is a crucial aspect of the qualitative study because without it the research is worthless, it helps to ascertain the trustworthiness and understandability of the research work. Meadows and Morse, (2001) work on verification and validity was utilized to achieve validity in this study.

Morse et al.(2002) defined verification as the process of checking, confirming, making sure, and being certain of results. Verification in qualitative research means the methodology used during the process of conducting the research effectively contributes to the reliability and validity of the study (i.e., rigor). In this study, verification was achieved through various means such as bracketing, coherence of methodology, and redundancy (Meadows & Morse, 2001). The researcher brackets his knowledge and

preconceived notions of the research subject before undertaking the study. The researcher accomplished bracketing prior to the research by dialoguing with a fellow researcher about his personal bias and past knowledge relating to the research topic. Furthermore, the research kept a memo during data collection and analysis to record arising bias during the research; this practice enables the researcher to keep his bias and preconceived notions at bay. Since the qualitative research method is iterative, the researcher was able to check for redundancy, when there was a similarity of data from different participants and circumstances (Meadows & Morse, 2001). Lastly, the researcher ensures all steps in the study was concurrent with the case study methodology.

Validation in this research was achieved by using multiple methods of data collection, including interviews and various documents. As a way of further ensuring validity, the researcher and his supervisors both reviewed the coding of the data to ensure consistency and ensures that different perspective of the respondents relating to the subject area is adequately captured.

4 Result

After an intensive data collection from the respondents, the goal of this chapter is to present the findings gathered from the data collection procedure. The chapter begins by providing a detailed overview of the selected for the research. The following section categorize the result into various theme to aid a better analysis of the data.

4.1 Case and Subject Description

Nigeria is a sub-Sahara Africa country with an approximated population of 190.9 million. The nation is divided into 36 distinct States, categorized into six geopolitical zones (North Central, North East, North West, South East, South South, and South West). In Nigeria, the health system is divided into three tiers, organized around the federal structure of the country, namely: The Federal level, State level and Local government level. These tiers depict the hierarchy structure in the health sector and define authority. The Federal level is responsible for health sector policy making; they provide technical support to other levels and the entire health sector. This level is also responsible for international relations on health matters; oversees the management of health information system and provides health services to the country through tertiary hospitals. The state level, on another hand, is assumed as secondary hospitals. The state ministries regulate and also offer technical support to primary health service providers (local level). Finally, the primary healthcare is the responsibility of local government, where health services are organized through wards.

Evidently, the public healthcare is well organized; however, in pure practice, services are poor. This outcome is attributed to inefficiencies in the local government, which renders health services to over 1million consumers in each local government. Underscoring the shortage of human resource, the World Health Organization (WHO) suggests that the doctor-patient ratio in Nigeria is 1:6325 as opposed to the world standard of 1:600. Furthermore, most of these medical institutions do not have an electronic platform for collecting and sharing health records; adding to the complexities of tasks undertaken by

doctors and extends poor delivery of healthcare service. To address this and other related problems in healthcare service delivery, the Federal government came up with an initiative – Health Sector Program (HSRP). However, record management in healthcare facilities is still profoundly despicable.

The current recordkeeping system used by most medical institutions is ineffective purely because it is paper-based system used. This system of recording keeping is predominant even in medical facilities with electronic health record systems due to the lack of an interoperable system in the health sector and loosely fitted purpose. More so, the healthcare service user is unable to get relevant healthcare information or any valuable resource. Although health service reforms have been devised to improve the availability of health resources, their management, community awareness, and involvement; notwithstanding, positive outcomes are yet to be achieved. Currently, consumers have limited, and minimal access to their health records and they are not actively involved in the healthcare delivery process. The implementation of a patient-centred Electronic health record will help address most of the shortcomings in the health sector. This thesis is undertaken to evaluate the current patient health record system in Nigeria, and the major issues associated with it.

Two categories of respondents were interviewed, which are: the patient (who are the major benefactors of the proposed system) and the healthcare professionals. The respondents interviewed originate from five geopolitical zones in Nigeria. A total number of fifteen (15) interviews was conducted, comprising of nine (9) males and six (6) females. The patients were sampled based on criteria that they are already familiar with healthcare system in Nigeria. Likewise, professionals were sampled based on work experience. Majority of the healthcare professionals had more than five years' experience in the health sector and were particularly interviewed to gain novel insight about adopting the PHR system and its effect on patients, institutions, physicians, and the nation more generally.

4.2 Presentation of Findings

After a careful codification of interview transcripts to ascertain the problem of the study, this section will further elucidate the information gathered. The inferences will be presented in different subjects (themes), based on what seems interesting to discuss and/or

relates to the research. Table 2 present the themes and associated codes gotten from the data analysis.

Table 2: Categorization of themes and related codes

Themes	related codes
Knowledge of EHR system	Medical recordkeeping, patient health record, EHR system
Barriers to PHR system adoption and use	Digital divide, fear of change, high initial cost, legislative bottleneck, corruption, awareness, abuse of the system, divulging of health information, trust, manipulation, literacy rate, rural area, poor internet service, security etc.
Metrics for measuring the benefit of PHR system	Accessibility, consultation time, data retention, evident base medicine, improved care delivery, continuity of care, transformational impact, record tracking, measurement of productivity Patient-physician communication, knowledge sharing, predictive tool, frequency of test conducted, cost and time saving, emergency condition, reduced travels, remembering aid, utilization of online resources, patient empowerment
Facilitators of the implementation of e-PHR	Commitment of the users, ongoing healthcare reforms and patient centered laws, android phone users, mobile internet subscription.
Role of key stakeholders	Training, trust, system usage, incentives and support, free public healthcare, feasibility of implementation, awareness program, legislative bottleneck, provision of enabling environment, interchange standards

Shortcoming of the current PHR system	Medical mistakes and errors, physical destruction of records, physician writing eligibility, poor reusability of health information, concealing of patient information, loss of health records etc.
Socio-economic benefit of electronic PHR	Growth of the economy, job creation, improved labour force participation rate, mortality rate, social welfare, research and managing disease outbreak.

4.1.1 Knowledge of the EHR system

This goal of this theme is to get a background knowledge of the current state of electronic records in Nigeria, we start by exploring the current state of EHR (since PHR is a subset of EHR). In this light, we try to answer the first research question "How to examine the current state of patient health record system in Nigeria." For a better study, the question was further sub-divided into two questions "What knowledge of patient health record system do the healthcare professionals and patients in Nigeria have". The first subsection explores the background knowledge of EHR, while the other section talks about the current state of PHR in Nigeria.

- **Electronic Health Record in Nigeria**

From the reviewed literature, it is evident that most countries in sub-Sahara Africa still predominantly use the paper-based recordkeeping system in healthcare service delivery. Nigeria is not excluded from this, as information gathered from the respondents (both healthcare providers and patients) provides support the fact that most healthcare service providers in Nigeria use paper-based recordkeeping systems. A fair share of the sampled population declared that based on their personal experiences the hospitals they have visited used the paper-based system. Two out of the total patient sampled stated that they had experienced the use of electronic based recordkeeping in medical institutions. Rationalizing the use of paper-based recordkeeping system, one respondent (healthcare practitioner) states;

"The general overview is that most people are still operating the manual system. Although some people are catching up with the electronic system but the institution in which I work mostly use the electronic system, but we have backups with manual because sometimes the electronic system fails due to power outage and some other issues, in situation like this we just fall back on the manual records." (Respondent).

It is then safe to state that healthcare service providers currently using the electronic recordkeeping system still depend on the paper-based system due to certain factors. From other responses, it can be postulated that the paper-based system is predominately used in Nigeria. However, the adoption of the EHR system is increasing as compared to previous years because of the benefits tied to its use.

- **Patient Health Record System in Nigeria**

Before proposing a patient-centric health recordkeeping system, it is vital to understudy how patients manage the information received from healthcare practitioners and the follow-on effect of their personal management of the data. Inferences from interviewees indicate that most physicians found new, the idea of a patient health record system. However, some patients stated that they have access to the healthcare records but only in the form lab test reports, prescription notes, and record of investigation (the outcome of medical consultations) which are kept in their homes (in paper forms). Contrary to this opinion, some respondents (patients) said that they have not got access to the medical records, but they only rely on their memory to remember what transpired on their last hospital visit or medical consultation. Furthermore, responses from most medical professionals reveal that patients are not allowed to access their health data and medical facilities store patients' health records primarily to serve their objectives. Opposing this fact, one healthcare practitioner states that:

"...most practitioners think that the patient should not have knowledge of their problems, but in my organization, we offer service to our patients, in that when they come we discuss with them their health problems, and if they want any information we give to them. We don't hoard any information. But most people and health establishment hoard information. The patient has the right to know what his or her problem is. That's my take on it…" (Respondent).

It can be deduced from the extract above that some medical institution in Nigeria doesn't support the patient to have access to their medical history for unknown and unidentifiable reasons. Also, the patient health record system is majorly paper-based, which is not effective because of the time constraint to get these records from hospitals. Similarly, are not having any sort of PHR (whether paper-based or electronic) to make informed decision as regards their health. Although, some patients have access to paper-based health records, this approach accompanies some challenges elucidated in the following section.

4.1.2 Shortcomings of the Current PHR system

One of the focus of this research borders on the limitations inherent in the current patient health record system in Nigeria. This section explores the challenges associated with the current PHR system in Nigeria healthcare system; thus, it addresses the research question "what are the limitations of the current patient health record system."

Findings posit that current patient health record systems are abysmal due to poor data retention procedures. In most cases the patients rely on their memory to reference information during diagnosis, which is often not concise and accurate, leading to higher consultation periods. Physicians usually rely on information provided by the patient as the hospitals have no previous history of the patient, and this might lead to inaccurate diagnosis. With the system, it is also easy for the physician to conceal and hoard vital information from the patient. The most prominent challenge with the current system is the inability to reuse or reference patient historical health records. It is a daunting task for the patient to transfer their medical records from one medical institution to another, if possible. In most cases, doctors are reluctant to transfer health-related information to another practitioner due to the scare of losing their patients. To buttress the problems with the current system, a respondent stated that:

"It is inadequate in the sense that assuming somebody in a city and for one or the other should find him or herself in another place and takes ill. We cannot readily get the information on that patient, for continuity of care the current PHR system is quite disabling." (Respondent).

An average number of respondents emphasized the issue "continuity of care" which is not practiced in the current system. The lack of data storage and resultant insufficiency

of information roots wrong diagnosis and in many other cases leads to complicating patient health problems. Furthermore, patients are not empowered; they have no access to their medical history to make informed decisions in terms of taking precautionary measures.

In a nutshell, the challenges with the current patient health record system are visible from the responses gathered and bothering most on the issue of continuity in care, founded on the availability of healthcare-related information.

4.2.3 Barriers to PHR System Adoption and Use

The adoption of electronic patient health record system in Nigeria's healthcare sector to alleviate the challenges currently faced by consumers will encounter inevitable challenges as with many technological projects. The aim of this theme is to explore the barriers of electronic PHR implementation and usage. For better analysis and presentation, the challenges to the adoption of e-PHR system is categorised into two categories; the first relates to barriers with the implementation while the other talks about the factors that may inhibit usage after implementation. The list of major challenges of implementing e-PHR drawn from the sample population is enumerated below.

- Confidentiality and Privacy concerns
- Digital divide
- Legislative bottleneck
- Lack of IT infrastructure in public hospitals
- Trust
- The technical know-how of some hospitals
- Lack of a data and interchange standard

One of the most arching issue to implement the e-PHR is the lack of supportive legislative frameworks. Data suggest that for this system to be implemented in Nigeria's public healthcare sector, it must be approved by the government and back by adequate legislative and regulatory instruments. Respondents believe that a greater magnitude of the challenge lies not in developing the statutes but passing them into law. This can be attributed to structural and process ambiguity in the legislative arm of government and corruption (as

evident in most pieces of literatures relating to failed projects in Nigeria). Referencing the words of one respondent:

"Yes, you know in anything you are introducing; it has to go through the National Assembly. And all those processes are bottlenecks before it will go through the first reading, second reading and comes out for implementation it normally takes a long time. So those bottlenecks are they. Getting thing done in Nigeria is difficult because it takes time before these policies are implemented and signed into law. This would be as a result of the poor leadership we have if we had good leaders if the legislature agrees on what they want and pass it on to the executive…" (Respondent).

Another prime concern highlighted in the findings is the lack of IT infrastructure and a common data interchange standard. Currently, most of the public hospitals in Nigeria do not have the necessary infrastructure (such as computers, network devices, etc.) to aid the e-PHR implementation. Additionally, there is no common data-interchange standard currently used by public hospitals delivering services with the e-PHR system. To implement an effective a interoperable e-PHR, it is vital to first implement a common data interchange standard for sharing data between the systems.

On another hand, project implementation does not assure effectiveness. Is it one thing to develop and implement a system and another thing for the intended users to use it effectively. Inferences from reviewed responses present some factors (listed below) that may limit the use of the e-PHR system in Nigeria.

- Low computer literacy rate
- Low health literacy
- Affordability (Poverty)
- Poor internet service
- Epileptic power
- Access to computers or devices
- Trust
- Poor experience of the system

Respondents were more concerned about the usage of the system in rural areas with the consideration that most people from the rural areas in Nigeria are living in poverty. Thus,

they are unable to afford the cost of using the system and lack education necessary to use e-PHR system effectively. In addition, the majority of resident in rural areas may not have access to electricity and internet network coverage. Affordability of the system will be a resounding problem, and this may lead to low levels in usage.

Health data are very sensitive data and should bare utmost confidentiality; concerns regarding privacy, confidentially, security and right of use were labelled as secondary challenges. Without an access control in the management data, there is the possibility of information leakage and misuse, which may lead to devastating events. This will reduce the trust of the system, and patients will be cautious with using the system

To sum up, many factors exist which may impede the implementation and use of electronic PHR in Nigeria. However, these challenges are not invisible and can be addressed. Literature providing the barriers and limitations to the implementing of an interoperable e-PHR in sub-Sahara Africa (Nigeria) is limited. Therefore, we rely on the data collected in this research, before proffering a solution to address the current problems in healthcare service delivery.

4.2.4 Facilitators of the Implementation of the e-PHR

This section seeks to provide an answer to a part of the research question "what are the barriers and facilitators to the adoption of the electronic health record." Although most respondents indicated their trust and commitment towards the use of the electronic PHR system if implemented because of the promised benefits of the system, some responses were conditional, established on trust with the organization managing the system and overall data security. In contrast, one respondent categorically declared distrust in the system for reasons related to management and security of data. With these responses, it shows that public interest, commitment and trust can be gained, which serves as a facilitator to the adoption of the system.

Another factor is the mobile phone penetration in Nigeria; this was highlighted by one the physician interviewed. Below is the opinion of a respondent:

"Android phone is almost in the hand of everybody. 40%-60% of adult in Nigeria have access to Android phones. So, if this system can be in the form of an app that can be

downloaded from the Google Play store or Apple store, you will see that it can be easily accessible…" (Respondent).

Although the statistic stated by the respondent was not entirely accurate about the percentage of smartphone users. IDC reported that, Nigeria with an estimate of the 193 million population, 162 million have mobile internet subscriptions, which is 84% of the populace. This is seen as a facilitator because if the electronic PHR can be accessible on mobile, then a large number of the population will have access to use the system.

4.2.5 Role of Key Stakeholder

For implementation to be successful, there has to be some level of shared responsibility between stakeholders. It is also crucial to identify the role of each stakeholder in the implementation process. Like with most projects, to achieve success in implementation, all stakeholders will need to accomplish some predefined roles or responsibilities effectively. To study the roles, we first classify the stakeholders into three groups and enumerate how each stakeholder's action or inaction will affect the adoption of the system.

- **The Government**

The federal ministry of health under the umbrella of the Nigerian government has a major role to play in the adoption of the e-PHR since the electronic PHR will be utilized by public healthcare facilities. For the patients and healthcare providers to embrace the adoption of this system, the government have a major role to play as implied by results. The adoption will affect social welfare of the Nigerian populace. Therefore, the government must be an active promoter of such a system. As proposed by one of the physicians interviewed, the adoption of the system must require government support in the form of policies, finance, and enactments that supports the implementation of the system. Below is an extract of her response.

"They have a role to play because is something that should be passed into law. It is to have legal backing before you operate such a system it needs to have legal backing and be in the constitution so that whatever is going to come from it will be bidding on everyone." (Respondent).

Like most respondents, the physician believes that the implementation of the system will require a key role from the government. However, there was a respondent that had a different opinion.

"I don't see the federal government being able to even implement this kind of project because we live in a country where we have a very high population. Not just the populate but the land mass and the land size, making it difficult to implement some sort of ideas, most especially ideas like this because we have a lot of healthcare facilities. In my opinion, I will suggest that the private sector should be the driver of such an idea, only for those that are willing and able to implement such a system in their healthcare facility..." (Respondent).

From the response above it can be depicted that some citizens have lost trust in government as a result of several abandoned public projects in the country aided by corruption. To resolve this problem, the government can partner with the private sector by leveraging on their skills, finance and competence in implementing, and managing the system.

Furthermore, one of the respondents said that the government also needs to provide an enabling environment for the implementation of the system. This entails providing computers and subsidized infrastructure for public healthcare facilities in the country in order to enable smooth adoption of the system. The government also need to define a unified data-interchange standard for all medical facilities using the interoperable system. This standard will aid the different healthcare facilities to communicate and share data. If healthcare users are not aware of the system, they will not be able to use. So, there must be proper awareness channelled to the end users. Likewise, proper orientation and education must be conducted to enlighten the public about benefits and the proper usage of the system.

- **The Healthcare Provider**

The healthcare providers should facilitate the adoption of the system by encouraging every patient under their care to use it. They could also help by assisting and providing relevant information to the patient that have a problem using the system. In short, for this system to be efficient and effective the healthcare provider needs to collaborate with the patient in using the system.

- **Vendors**

The vendor has a role to play in that they should work with the healthcare facilities to provide a patient-centred system and one that is user-friendly. The vendor can also develop a system with the option of different tribal languages because of the cultural diversity in Nigeria. They should also consider the inclusion of citizens with special needs and senior citizen of the countries. All of this should be put into consideration when creating the e-PHR system. The healthcare provider should encourage the adoption of the system; in a situation where a patient needs clarification of the information in the system, the healthcare providers should be available and able to explain to the patient.

4.2.6 Metrics for Measuring the Benefits of e-PHR System

The implementation of an electronic PHR system can be motivated by presenting its potential benefits as against current health recordkeeping system. While various literature postulates lots of benefits derived from the implementation of electronic PHR in many developed countries, there is limited research conducted for countries in sub-Sahara Africa which Nigeria is part. This section presents the benefits suggested by respondents categorized into three sections (healthcare delivery, patients and healthcare providers, and socio-economic benefits).

- **Benefits to Healthcare Delivery**

The implementation of electronic PHR can accompany a lot of promised benefits for the public healthcare delivery system of Nigeria. The quality of public healthcare service delivery is despicable and of great concern of the populace. Most of the problems in the public healthcare sector will be solve by implementing an e-PHR. Respondent restated, the implementation of e-PHR system would save time during the consultation due to the accessibility of patients' historical health record. It enables better and timely conclusions. An extract from the resulting transcript provides a vivid depiction of this notion.

"Yes, that will be awesome because attending to the patient will be quick rather than slow which is what is predominant in Nigeria. To attend to a single patient takes a lot of time and if you want to be attended to in the clinic, you must go to the clinic as early as 8 AM and probably you will be attended to 4 PM in the evening, so electronic patient health record will save this time." (Respondent).

With the system in place, patients can track the quality of healthcare services rendered, since they have access to information in the system. One of the medical practitioners affirmed that if such a system is in place, medical providers will be more careful because there is evidence of their action or inaction (prescriptions and diagnosis). Thus, the quality of healthcare will improve as there will be fewer errors and mistakes made by medical practitioners. Another prominent issue presented by most respondents was related to the continuity of care. Currently, there is no form of communication between healthcare facilities which limits patients from continuing care in a different facility when necessary. To buttress this point, one of the medical providers posits:

"It is inadequate in the sense that assuming somebody in a city and for one or the other should find him or herself in another place and takes ill. We cannot readily get the information on that patient, for continuity of care the current PHR system is quite disabling." (Respondent).

The absence of previous patient health records may lead to wrong diagnosis, wrong treatment and in some cases, increases the severity of the health condition since the medical practitioners do not have an idea of historical health data (past prescription, allergies, lab test, etc.). The implementation of e-PHR will provide a precise and concise medical history about the patient to medical practitioner anywhere and at any time and this will aid continuity of care which is very vital in the healthcare service delivery.

- **Benefits to the Patient and Healthcare Providers**

The e-PHR delivers a lot of benefit for the end-user (consumer) and healthcare providers. It is a wide belief that one tangible benefit of the system to patients is empowerment – patients' right of control over their health. The utilization of e-PHR system enables patients to track their personal health records and monitor their health. Health monitoring with the use of e-PHR system will help the patient to curb unhealthy lifestyle as they are well informed about their health. Patients are also equipped to share knowledge with the medical provider which will facilitate shared decision-making that would lead to improved quality of care. One of the physicians explained that if the patient is knowledgeable about their condition, it would be a positive development and the practice of medicine will grow.

Furthermore, the adoption of the interoperable electronic PHR will also save cost for the patient and time for the physician. It will reduce the cost for the patient, especially in public healthcare facilities as they can easily move to a different healthcare facility. Besides, healthcare service users will no longer need to pay for a necessary or basic medical test that has been performed before. On another hand, electronic PHR will facilitate a faster diagnosis of medical conditions, providing time for the healthcare provider to attend to more patient (increased productivity).

Formerly, most patients in Nigeria have limited access to their prescriptions and are required to revisit the healthcare provider for restocking. However, the adoption of the electronic PHR will enable the patient to have access to their prescriptions administered to them. The electronic PHR system will serve as a database for patients and medical practitioners. As complained by one health provider:

"Some of them don't even know the drugs that they are on but if you have this system where everything is electronically operated, you can always log on and see how to manage the patient. And even if a patient has an insight into what he or she has and the drugs he or she is taking it will go a long way." (Respondent).

To buttress this point, access to health information will improve patients' compliance with drugs administered by the healthcare provider since they can easily access their prescription. Effective patient-physician communication is one of improving the quality of healthcare delivery. Electronic PHR system has the capability of facilitating effective communication between patient and physician. From interviews conducted, most of the respondent stated that the communication between both parties will be beneficial if patients can also book an appointment using the system. Booking of appointment electronically via a PHR will "reduce travels" as stated by the respondents. Below are the words of one of the respondents:

"Another thing is that it will save us a lot of travels because there will be no need for someone to say "I don't have my medical information here" so I need to go to where it is to obtain it. So, if we have this electronic link, it will be easily accessible, and the travel will be less, and all is centered around cost saving." (Respondent).

An important component of the e-PHR can provide useful health resources to end-user (patients), explaining medical terminologies and general information of medical subjects.

From the interview conducted, it was gathered that 90% of the consumers interviewed were in support of such a feature except for one consumer that condemned it because it will service self-medication which may be detrimental to the health of patients. In the respondent's exact words:

"No, I don't it is beneficial. I think it will do more harm than good. People will check their symptoms and believe that they have some time and won't go to the hospital to confirm or run any test. I totally believe that self-medication will be high if there is something like that in place. I don't think It will be very helpful." (Respondent).

In light of her response, it can be assumed that the advantages of the system can also serve as a disadvantage to some end-user. Therefore, there should be precautionary information and measures guides the patient on how to use the e-PHR system.

4.2.7 Socio-Economic Benefit of e-PHR

More generally, the implementation of an electronic PHR system promises a great impact on the state. To underscore this impression, inferences point out benefits derived from the availability of information, making it possible for patients to monitor and be more aware of their health. Correspondingly, patients can restrain from unhealthy habits and live a healthy life. In the long run, this reduces mortality rate and consequently increase the labour force in the country. As stated by a respondent:

"I think because the patient would have access to their medical records, they will able to curtail the kind of things they do, like in terms of what is good for their wellbeing and health. In so doing we would have a lot of healthier workforce in the country. And that will subsequently boost the economy. It will increase the labor force." (Respondent).

Moreover, the implementation and management of the electronic PHR is an information technology project and will involve employing a skilled workforce which will directly create jobs for the populace. The interoperable electronic PHR system with a section of it available to the government will help manage disease outbreak and research of various diseases.

"Yes, because it won't just benefit Nigerians, it will also benefit the federal government because they should have the right to own a percentage of the record system which will

be helpful in case of a disease outbreak and to enable them to track the source of the disease." (Respondent).

4.2.8 Summary

The chapter opened by giving a summary of the characteristics of the respondent interview during the research. It went further to provide a detailed analysis of the responses collected from the interviews based on the research questions. Each of the research questions was divided into sub-questions and all this question was attend to by the data we collected from the interview. Each of the sub-questions was later divided into interview questions that enable an effective data collection from the respondents.

5 Conclusions and Future Work

5.1 Introduction

From the reviewed works of literature and discussions in previous chapters, it is evident that an interoperable e-PHR will accompany a lot of promised benefits for healthcare service users. However, there are also major barriers to the successful adoption and use of electronic PHR in Nigeria. The goal of this chapter is mainly to provide recommendations based on the findings and discuss the feasibility of implementing the proposed system. This chapter has three sections. The chapter starts by proposing a suitable e-PHR system for the Nigeria healthcare system and the benefits of adopting the proposed system. The second section entails the researcher's recommendations relating of the adoption of the system. Lastly, the impact and limitations of the research were explained.

5.2 Proposed Electronic Patient Health Record Architecture

Each of the various PHR architectures has some benefits it renders and limitations that may discourage its use. To have a truly efficient electronic PHR system, the system should communicate the provider's EHR. If the system cannot exchange and share data with the various system, the e-PHR will become an information island which will result in the system not delivering the maximum value to its users. The interoperable electronic PHR have the functionality to interact with other systems in the healthcare network. However, with the standalone and tethered e-PHR, there is no connectivity between this system and the healthcare providers system, hence consumers moving to a different medical institution or a geographical area will find it difficult to transfer their health information to the new environment. Nevertheless, the interoperable or integrated e-PHR have functional capabilities that enable different health information system to share data.

To achieve this interoperability, electronic PHR should support data and interchange standard as used by other health information system in the country. Without this common

record standard in place, it will be difficult to implement and manage the interoperable e-PHR. This might be an issue because most health institution in the country does not currently have a common standard. The ministry of health in conjunction with the federal government of Nigeria will need to enact a common interchange standard used by all health information system throughout the country to enable the seamless integration of various electronic health records system.

Standards for e-PHR are rules that ensure that patient health information is transmitted, stored and accessed by all relevant stakeholders in the health ecosystem. The Health Level Seven (HL7) workgroup have provided numerous interoperability standard framework that various health information system uses to communicate with each other. The group has developed a PHR-System functional model (PHR-S) framework that defines the function of PHRs and addresses the issue of privacy, security, and interoperability between system. HL7 also have relevant standards that address both syntax and semantic interoperability issues such as SNOMED, LOINC and the HL7 Clinical Document Architecture (Heubusch & Kevin, 2008). Authentication of the user is another issue associated with the various PHR architecture. Standalone PHR is relatively safe since it is under the control of the patient, except the devices were lost or the content was not encrypted. Though the interoperable PHR has a lot of benefits, the issue of authentication remains a daunting task because the interoperable PHR is a component of an integrated healthcare system. Hence, before the information is shared between the health system, the identity of users' needs to be verified to ensure optimum security.

5.2.1 Benefits Associated with the Integrated e-PHR

According to Detmer D. et. al (2008), the integrated PHR will bring about a transformational potential to the patient and healthcare system. The data alone in the electronic PHR is not enough to realize a revolutionary impact on the healthcare service delivery process. The key benefits of e-PHR can only be achieved if the e-PHR system accepts data from different sources to provide a robust system for the patient to effectively participate in the healthcare delivery system. During the interview most of the respondent stated some of the challenges facing the current patient health record system in Nigeria, the integrated electronic PHR can attends to some of these challenges.

One of the most reoccurring problems stated by the respondents during the interview was the issue of accessibility and availability of health information. The integrated e-PHR has the capability of presenting a complete and concise health information since health data are derived from different healthcare provider system. Hence, integrated PHR improves the availability of information during diagnosis of a patient, and this will save time for healthcare providers to getting patient history and channel this gained time into probing deeper concerns and clarification about the patient ailment. The integrated e-PHR system will also improve synchronous and asynchronous communication between the patient and healthcare provider, with this communication in place patient will easily book an appointment with the doctors and inquire about their health when necessary in the case of emergency.

The integrated PHR will tremendously reduce cost and time for the patient. Since the integrated PHR is connected to several provider EHR systems, there will be sharing of patient and administrative information between the system. This will thereby reduce unnecessary cost associated with repeated and basic test previously done the patient. A medical practitioner interviewed stated that healthcare providers in the public healthcare system in Nigeria are always stressed as a result of the workload. With the integrated e-PHR in place, the providers will be able to spend minimal time in inquiring and collecting patient information since all patient information can be seen in the e-PHR system, this will save time for the patient as well as the healthcare provider. Furthermore, the integrated e-PHR system will also facilitate the use of online consultation which is more convenient and time saving for both parties involved in the healthcare delivery system.

5.3 Recommendations for the Implementation of e-PHR System

Data collected indicates that, a willingness among citizens to adopt an electronic PHR. The motivation behind this is because the e-PHR is believed to help users meet their health goals such as monitoring their health records, viewing prescriptions, etc. Respondent also see e-PHR as a tool of empowering patients to take greater control of their wellbeing and make an informed decision. Barriers to the implementation of the e-PHR system were related to usage (confidentiality, health and technology literacy, etc.) and poor infrastructural development (e.g. power and internet). As a result, the researcher

suggests some recommendations for the adoption of e-PHR system records which is enumerated below:

5.3.1 Legislative Support from the Government

Contemporarily, there is a move by healthcare service providers to keep their records with patients' needs in focus. This has also necessitated a need for an electronic PHR that primarily engages the patient and serves their needs. The proliferation of information technology has facilitated the adoption of electronic patient health record in developed countries. However, the successful implementation of e-PHR system in Nigeria will require legislative support from the Nigerian federal government. Although, the government have had health reforms that aim to enhance consumer awareness and involvement to solve problems inherent in the Nigerian healthcare sector. Notwithstanding, quality of service in the healthcare in Nigeria is poor and it remains an emphatic concern to the populace. One of government's effort to attend to the organizational and financial challenges facing the national health system is the Health Sector Reform Programme (HSRP). The reform consists of seven strategies. Though one of the strategies in the reform was to "improve consumer awareness and community involvement" much has not been done to this effect.

Secondly, there is also a patient bill of right developed by the Federal Ministry of Health in collaboration with the Consumer Protection Council. The purpose is to set a foundation for open, transparent communication between the patient and the healthcare providers. It provides patients with access to a detailed and accurate medical record, and actively take part in the healthcare decision-making process. However, regardless of these regulatory legal frameworks supporting the patient centred approach; there is limited legislation backing the implementation of technological components or systems that encourage patient involvement. The federal government can take a cue from the United States' HITECH Act that provides human and health service (HHS) with the authority to develop programs to improve healthcare efficiency, quality and safety through the promotion of ICT in healthcare. The National Health Act (NHA) is responsible for enacting laws regulating the healthcare sector in Nigeria. The NHA can make an adjustment to the current legislative framework to include a provision for the adopt and use healthcare technology systems that support the patient centred approach to healthcare delivery.

5.3.2 Public-Private Partnership

One critical factor the federal government needs to take into consideration in order for the implementation of this project to be successful is public-private participation. There is need for effective collaboration between the private and the public sector. One of the respondents asserts that if the interoperable electronic PHR implementation is left to the federal government, it is bound to fail because of corruption and nepotism that exist in this sector. Therefore, the government should employ resources and skill from the private sector to implement and manage the project.

5.3.3 Adoption of EHR System

There are various types of PHR as stated earlier, but the proposed PHR for this study is the interoperable electronic PHR, one that shares and transmit information with providers' EHR. Thus, as a prerequisite to implement and effectively use the interoperable electronic PHR, EHR should be adopted by healthcare facilities across the country. Currently, some healthcare facility utilizes EHR system, but to get the promised benefits associated with using an interoperable e-PHR system, there is a need for widespread adoption of the EHR system to allow for information sharing between solo EHR providers and the e-PHR.

5.3.4 e-PHR Data and Interchange Standard

The integration of health information from different sources will require common data and interchange protocol and standard; used by all healthcare facility in order to promote privacy, security and interoperability of health information shared. Presently, there are different standards to identify the utilization of e-PHR in most developed countries, an example of such standard is "the Continuity of Care Record (CCR), the HL-7 Clinical Document Architecture (CDA), and the Continuity of Care Document (CCD), etc." (Tran & Gonzales, 2012). The government should ensure that common data and interchange standards and protocols are used to enable interoperability within the health information ecosystem.

5.3.5 Health Information Technology Infrastructure

The federal government and relevant stakeholders need to provide an enabling environment where such system can thrive. With reference to the term enabling

environment, provision of adequate infrastructures (such as electricity, computer, and reliable internet services) to facilitate the adoption of the e-PHR should be considered by the government. Though the government has partnered with the private sector to make reliable internet available in some cities, the issue of affordability remains. Additionally, most rural areas in Nigeria still does not have access to quality internet services. For the electronic PHR to gain widespread usage across the country the government will need to resolve the issue of poor internet service.

Furthermore, the epileptic power supply is an emphatic problem in Nigeria, as identified by most respondents interviewed. To effectively utilize the proposed system, the government should also provide stable power supply across the country. Extending this notion, the government should provide computers and network devices to all public medical facilities in Nigeria to facilitate the implementation of the EHR which is successively linked to the interoperable electronic PHR.

5.3.6 Appropriate Awareness Programmes

As evident in the interviews conducted, appropriate training and awareness programme needs to be undertaken by the government to motivate usage of e-PHR system by consumers. Nigeria is a country with a massive and diverse population, so the government needs to make the populace aware of this system. Furthermore, health and technology illiterate compromise a huge part of the population, so the government needs to educate the consumers on how to effectively use the system, this can be accomplished via the televisions programs or training programmes organized in each community to teach the citizens on how to use the system.

5.3.7 Use of Incentive Program to Aid Adoption of e-PHR System

The adoption of the interoperable electronic PHR will face major challenges related to use by physicians and end users. For instance, physicians may discourage the use of the system because it will involve additional unremunerated tasks (e.g. simplifying medical terms in the e-PHR for better understanding by patients, inputting data into the EHR system which is later transmitted to the interoperable e-PHR for the patient). The patient, on the other hand, may frown at using the system as a result of its complexity compared to the paper-based system. The government can learn from the United States' meaningful use incentive program to distribute financial support to healthcare providers adopting

electronic health record technologies. As a way of encouraging both patient and physician to use the system, the MU EHR incentive program requires 5% of a physician's patient to be actively involved with e-PHR technologies in managing their health information for the healthcare provider to qualify for this benefit. Further, as a prerequisite for the incentive, the patient should be able to get access to health materials and effectively communicate with the physician using a secure messaging platform (PHR). With this kind of incentive system put in place in Nigeria, the healthcare provider will encourage their patient to use the electronic PHR, so they can acquire this incentive, and this will lead to an increased PHR adoption rate.

5.4 Implication

This research identifies the problems with the current patient health record system in Nigeria. It went further to propose an appropriate electronic PHR that attends to the current challenges faced by consumers in Nigeria. The study also provides answers to how electronic PHR system address the current challenges in the Nigerian healthcare system and provides a scheme to successfully implement the e-PHR system in the Nigerian healthcare. It is not news that the healthcare quality in Nigeria is poor; however, the implementation of the proposed system will attend to some of the challenges currently faced in the healthcare sector. The study brings a new perspective of how to better involvement patient in their healthcare using the PHR technologies.

5.5 Limitations

One of the limitations of this research relates to the financial constraint of the researcher to conduct a face-to-face interview with respondents from all six geopolitical zones in Nigeria, in order get a better representation of the studied population. Although it was somewhat possible using the internet, respondents from the rural areas were inaccessible due to no and/or poor internet accessibility. Also, the researcher was unable to interview two physicians because they were not in support of the interview being recorded for privacy and confidentiality reasons.

Another limitation inherent in the study is the chosen methodology. A case study is suitable for this research but has its weaknesses. With case study research methodology,

there is an issue of generalization because case study focuses on a single instance. Some scholars criticize the case study research as being weak in term of making broad generalization as compared to the survey design. This issue has been attributed to the small-N problem inherent in case study design.

A qualitative case study is also limited because the researcher is the primary instrument of data collection and analysis. This has its advantages and drawbacks. One of the drawbacks is that researchers do not usually have access to training in observation and interviewing, even though it is necessary. The researchers are mostly relying on their abilities to conduct the data collection procedures which may be exposed to bias.

5.6 Recommendation for Future Work

Based on the relevance of this study, further research can be conducted using a mixed methodology which involves a qualitative and quantitative approach into relevant subjects such as health and digital literacy in Nigeria, behavioural changes associated with the adoption of the system.

Research on how to motivate and incentivise people to use the PHR effectively and improve the usability of the system can be conducted. The people in question represents all stakeholders in the healthcare delivery process.

Further studies can be conducted to design an electronic PHR that is responsive to the need of the elderly and persons with special needs to understand their expectations on the system and how they can use the system effectively. Lastly, future research could focus on designing and implementing an e-PHR prototype for the Nigeria healthcare system.

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Appendix 1 – Healthcare User's Interview Questions

Introductory questions

1. What is your occupation?
2. What is your gender?
3. What is your age?
4. What part of the country are you from?
5. What is the highest level of education you have completed?

Knowledge of Health Record Management System

6. Have you ever used medical service in Nigeria before?
7. If yes, when was the last time you visited the hospital?
8. Do you have any idea of electronic health recordkeeping in medical institution in Nigeria?
9. The hospital you visited what kind of health record system was predominantly used there (paper or electronic based)?
10. Do you have any knowledge of patient health record, If Yes what kind?
11. Have you ever had access to your medical records in any form before, if yes what form?
12. Is the current patient health record system sufficient? if Yes/No why?
13. Do you think it will beneficial to have an electronic patient health record in place that enable patient get access to their medical record and own their data?

Patient use of the system

14. If the e-PHR system was implemented will you actually use the system?
15. What is your level of computer literacy?
16. Is learning to operate a new type of computer software difficult for you?
17. will you need assistance in using the e-PHR system?
18. If the e-PHR system is adopted, will you trust it. If Yes/No Why?
19. Do you know what health resources are available on the internet?
20. Do you feel confident in using information from the internet to make health decision?

The benefits of Patient Health Record

21. What are the principal benefits associated with the use of electronic personal health record?

22. Do you think using the e-PHR would improve your overall patient health?

23. How would the e-PHR be useful in maintaining a healthy lifestyle of patient?

24. Do you think e-PHR will be useful to communicate with medical professionals?

25. How will this improve the social welfare, labour force participation rate and the Nigerian economy?

The barriers and challenges of implementing Patient Health Record

26. Are they some risks or inconveniences linked to the use of e-PHR (for the patients, their relatives, the healthcare providers). What are they?

27. Are they elements that may limit the use of e-PHR? What are they?

28. In your opinion, do the federal government have a role to play in the implementation or use of e-PHR?

Appendix 2 – Healthcare Provider's Interview Questions

Introductory questions

1. What is your occupation?
2. How many years have you work in your current position?
3. Briefly describe your role in medical institution?
4. Which sector do you work?

Knowledge of the current system and Patient Health Record

5. What is your knowledge of Electronic health record?
6. Do you use any form of Electronic health record (EHR) in performing your task?
7. If Yes, how has EHR changed your daily task?
8. What is your knowledge of patient health record in Nigeria?
9. Has the current patient health record been efficient? If Yes/No Why?
10. Do you have any knowledge of Electronic Patient Health Record?
11. If Yes, do you know how it works?

Adoption of Patient Health Record and the resulting benefits and drawbacks

12. Do you think implementation e-PHR system is feasible in Nigeria?
13. If PHR is implemented, is there any change to how you interact or how information is shared?
14. Will the implementation of e-PHR system change the approach to decision making in care delivery?
15. How do you feel the system will change care delivery (i.e. the structure of care delivery and changes in relationship between people)?
16. Do you think e-PHR system would play a critical role either positive or negative in clinical/administration decision making?
17. Do you think the implementation of e-PHR system has a big impact on patient healthcare?

18. if yes, what are the principal benefits associated with the use of electronic personal health record (e-PHR) (for patients, for physicians and other healthcare professionals)?

Benefits and inconveniences to e-PHR use

19. Are they some risks or inconveniences linked to the use of e-PHR (for patients and relatives, physicians, other healthcare professionals)? What are they?
20. What are the factors that would facilitate the use of e-PHR?
21. Are they elements that may limit the use of e-PHR by patient?

Barriers and facilitators to e-PHR implementation

22. What organization-wide effects do you perceive relate to the e-PHR system implementation negative/positive?
23. What are the socio-economical and nation-wide effect do you perceive relate to the e-PHR system implementation?
24. What are the key challenges to the implementation of e-PHR system?
25. In your opinion, what are the legal factors that can influence the implementation or use of e-PHR system?
26. Do the federal government have any role to play in the implementation of e-PHR system?
27. In your opinion, how can governmental policies influence the implementation or use of e-PHR system?

Appendix 3 – Thematic Map of Categories and Codes
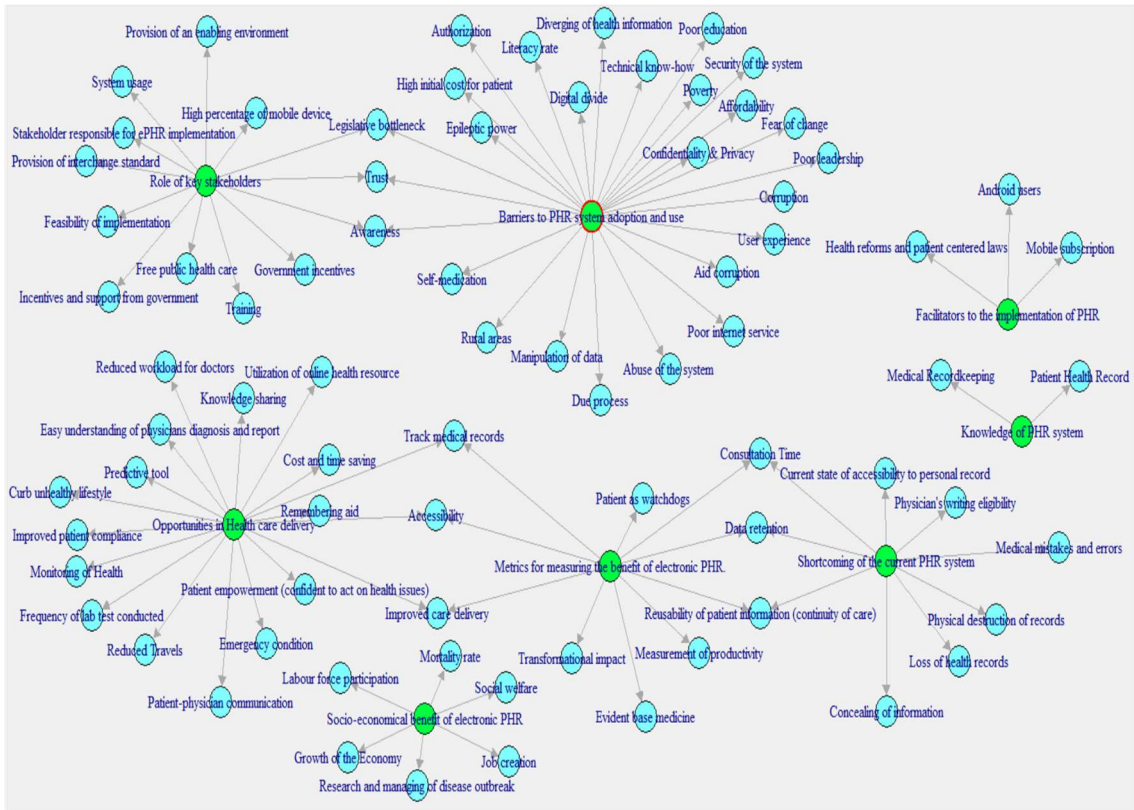
Appendix 4 – Link to Audio and Transcript

Below is a link to all interviews conducted and their respective transcripts.

https://drive.google.com/drive/folders/1w9_3H8Tw8pzUWtxQensO31n88UVbjOSk?us
p=sharing