Chapter One

Introduction

1.1 Background to the Study

The diversity of health information management services, platforms, and sources is constantly expanding in the developed world. For creating, processing, communicating, and using information in the healthcare delivery industry, electronic technologies have advanced quickly. The application of information technology in health information management practice (HIM) is a moved from paper base to electronic health record system using computer application and packages. This is supported by ITs' capacity to collect, store, retrieve, review, and transfer massive amounts of health records across numerous locations[1]. The use of ITs in-healthcare delivery, or "E-health," has been hailed for strengthening healthcare delivery systems through a variety of innovative applications and programs that are specifically tailored to the needs of the industry. One such program is the electronic health record (EHR)[2]. IT encompasses a wide range of software, hardware, and networking technologies whose primary purpose is to collect, store and transmit health data among the different stakeholders in the healthcare system[3]. Health-related data about patients has historically been gathered and written on a variety of papers and forms, which are then physically stored on shelves and in cabinets that are too small to hold the volume of data. One of the most important elements in improving the quality of health care delivery worldwide is health information management. Reliable health information management results in timely health policies and planning, which enhances a nation's overall state of health. It also plays a crucial role in controlling and enhancing the delivery of healthcare at individual health institutions[4]. The use of ICTs in healthcare delivery, improves access to healthcare facilities for both patients and healthcare professionals as well as the quality of care provided, both of which translates

into productive labor and the overall development of the nation[5]. Additionally, research shows that integrating IT with patient information management has been a successful strategy to lower medical errors, duplications, clinical decision delays caused by information gaps, etc[6]. The administration of patient data using IT in patient care can enhance patient care and save healthcare expenses[7]. The goal of Health Information Management (HIM) profession is to ensure the effective management of patient information and healthcare data that is valuable to the delivery of quality healthcare service and treatment to the people in the community. Hence, the role of hospitals in the healthcare delivery system of any nation is highly imperative[8]. There are several benefits to using information technology to handle the administration of complex information resources, including better procedures and cost reductions. Healthcare businesses have seen several changes on how IT is implemented, and IT is now playing a bigger part in the delivery of healthcare. With all these technological advancements, healthcare institutions may now access systems that operate efficiently and provide better record management services[9]. A new dimension has been added to many human endeavors with the help of technology. When necessary, it aids in closing the information gap, while also helping to create one when one is required[10]. Diverse information technologies (ITs) are being incorporated into the healthcare systems of developing nations in order to save lives. This involves facilitating communication, using evidence-based decision-making, incorporating e-learning for remote health professionals, using it as a means of accessing recent healthcare information, and data handling and processing activities among staff[11]. It has been discovered that a fundamental strategy to current efforts in the transformation of the healthcare delivery system in high-income settings like Europe is the application of information technology in the healthcare delivery system. The free exchange of information between healthcare facilities improves data accuracy and clinical documentation of patient information, and better patient care quality have all been

demonstrated by numerous researchers, who also support the use of IT in transforming health information management practice[12].

Despite the fact that the use of ITs in-healthcare delivery is not a new concept in the world, its adoption and promotion have become especially important in resource-constrained developing nations whose healthcare systems are characterized by severe financial, infrastructural, technical, and human resource constraints[13]. The Nigerian government is also making significant investments in IT-based Health Information Management Systems in an effort to enhance healthcare and the overall effectiveness of public healthcare institutions[14]. Huge financial investments have been made in the adoption of IT applications in the Nigerian health sector, not only by the government but also by other private persons, including international clinic hospitals in Kano and Abuja as well as other foreign organizations using IT products and services for managing health data and information is not a straightforward free-flow operation, it has some obstacles that must be removed in order to accomplish the goal of smooth information sharing. The quality and comprehensiveness of the healthcare provided in terms of cost and accessibility are factors that are used globally to evaluate the healthcare delivery system. However, despite Nigeria's robust healthcare delivery systems, they are still classified as being below because most people continue to have insufficient access to healthcare services and health data. In Nigerian, public health facilities have been claimed to have several instances of delay in obtaining patients' medical records or information. Additionally, the Nigerian healthcare delivery system has gotten worse over time. The majority of public health institutions and centers have not kept up with the global trend of information management, and it is frequently discovered that patient health information is wrongly stored, making it challenging to retrieve patient health information for treatment. As a result, it results in poor judgment and extended patient waiting times. The associated challenges of using IT in health information management practice has been

documented to include lack of standardization which prevents the implementation of an integrated and interoperable system that enables seamless information sharing within and outside of health institutions and ensures the protection of patients' health information privacy and confidentiality[14]. IT usage involves a lot of resources, including trained labor, sophisticated technology, and financial resources, all of which can be challenging to overcome in low-income settings, the art of preservation and management of health data has given rise to a number of challenges over time[15]. Therefore, there has been a sharp increase in the usage of information technology (IT) based solutions in health information management as a result of the necessity to develop and organize new ways of providing efficient health record services. The application of IT product in HIM practice at the university Collage Hospital Ibadan is facing challenges on documentations due to the use of papers and other non-electronic system, despite the facts that, the practice is as well on the transformation of migration from the paper based to electronic health record system. It is against this background that this study attempts to assess the Application of Information Technology on Health Information Management Practice in University College Hospital (UCH), Ibadan.

1.2 Statement of Problem

Evidence of ineffective health care delivery in Nigeria is clear, and therefore, has attracted comments and criticisms from individuals, at the primary, secondary and tertiary levels of healthcare[16]. The lack of effective health information management systems in Nigeria is due to the reliance on paper-based and disjointed health data management systems[17]. Nigeria is still struggling to ensure health care services are effectively provided and even with the current health sector reforms by the government, the healthcare delivery system is still inefficient in all areas while the population keeps growing.

It has been confirmed that the challenges facing health care services in UCH could be linked to improper use or lack of health information in implementing health policy or other health-related programs within the hospital because they have not been actively involved. The provision of adequate comprehensive health services to the people is a critical issue to be addressed.

Healthcare delivery is sometimes impaired with the current use of temporary cards in UCH when the original case note has gone missing when needed. The upsurge in the number of patients seeking health care services requires fast and efficient record keeping. This is one of the driving forces behind the research into the barriers militating against the implementation of IT in the facility. Evidence have revealed that patients often lose their personal reference card or unable to produce their unique identification number, thus making it difficult to trace their record at the point of entry for healthcare access in UCH.

The data/information generated and used among healthcare professionals is faulted for poor quality as a result of incomplete health records or illegible hand writings which causes clinical errors, the failure to provide recommended treatments for patients with certain medical conditions or resulting to deaths in some patients from process errors. In Nigeria, increase in medical errors is alarming and has contributed to the high number of preventable deaths, about 75% combined prescription errors were found to have one form of error or the other [6].

1.3 Justification of the Study

Information technology has potentially contributed to the improvement of patient safety, professional efficiency, and patient satisfaction in healthcare. A lot of effort has been directed to the adoption and application of Information Technology in Healthcare, especially in health information management practice. Though, both developed and

developing nations have a keen interest in implementing EHR, benefits of the EHR include accurate data management and storage, and a reduction in the data replication. The study was done as a way of assessing the application of information technology on health information management practice in University College Hospital Ibadan. The application of IT on HIM practice hasn't been previously documented in UCH. Through this research, the HCWs improved the quality-of-service delivery in providing HIM practice using IT product by ensuring proper utilizations of information technology on HIM practice in UCH. The study emphasized on the application of IT on HIM practice. The study also justified the challenges and contributions of HCWs in providing HIM practice using IT. The findings of this study provided information on the applications of IT on HIM practice in UCH.

1.4 Aims and Objectives of the Study

The aim of the study was to assess the Application of Information Technology on Health Information Management Practice at University College Hospital (UCH), Ibadan.

1.4.1 The Objectives are to:

I. To determine the staffs' attitude towards IT application in HIM practices on health care delivery in UCH, Ibadan
II. To examine the benefits of IT application on HIM practice in UCH, Ibadan
III. To assess the level of IT application in HIM practice in UCH, Ibadan
IV. To identify the challenges associated with IT application in HIM practice in UCH, Ibadan

1.5 Research Questions

1. What is the staffs' attitude towards IT application in HIM practices on health care delivery in UCH, Ibadan?

2. What are the benefits of IT application in HIM practice?
3. What is the level of IT application in HIM practice in UCH?
4. What are the associated challenges with IT application in HIM practice in UCH, Ibadan?

1.6 Statement of Hypotheses

At 0.05 level of significance, the study will formulate and test the following hypotheses:

Hypothesis 1:

H_0: There is no association between attitude towards IT and its application in HIM practice

Hypothesis 2:

H_0: There is no association between challenges and application of IT in HIM practice

1.7 Significance of the Study

The main Significance of the study is to contribute to knowledge by adding to the existing literature on the application of IT on Health information management practice among healthcare workers. The study is one of the few that assessed the application of IT in HIM practice in University College Hospital Ibadan, Oyo State, which can be used to establish the basis for further research in the state. The findings of the study will be of greater benefit to the following:

Policy Makers: The study will inform the policymakers on the application of IT in HIM practice among HCWs in UCH Ibadan which can enable the policymakers to develop strategies/guidelines to enhance the application of IT in UCH.

Healthcare Workers: The study will inform healthcare workers on the benefits and the associated challenges on the use of IT products in HIM practice and as well to recommend the possible solutions to such problems.

Researcher: The study will enable the researcher to identify the existing constraints that affects the application of IT in HIM practice.

Lead City University, Ibadan: This study will inform Lead City University about the current situations on the application of IT in HIM practice in UCH. The findings can be used by the University to establish the basis of further research on the Area of IT application on health management practice among healthcare workers.

1.8 Scope of the Study

This research work covers the health care providers of the University College Hospital, Ibadan under Ibadan North Local Government area of Oyo State. The personnel included were HIMs, doctors, nurses, scientists, physiotherapists, pharmacists, community health workers, etc. Also, the study focused on the assessment of the application of information technology in health information management practice at the University College Hospital, Ibadan.

1.9 Limitations

In spite of the diversity of healthcare delivery, a universal technical acceptance model for e-health is hardly feasible. Due to incapacity and other associated constraints, the study was limited only to University College Hospital Ibadan and among healthcare workers using IT product in clinical departments alone without considering those from the non-clinical departments to bridge these limitations, the further study should include wider coverage and integration of all workers using IT product in delivering HIM practice. In view of this, the

result may not be a true representative of the whole population of healthcare workers on the assessment of application IT in HIM practice in Nigeria.

1.10 Definition of Terminology

1. Application: An application is a computer software package that performs a specific function directly for an end-user or, in some cases, for another application

2. Electronic Health Records (EHRs): EHRs are defined as a longitudinal collection of electronic health information for and about persons across different institutions and sectors where health information is pertaining to the health of an individual.

3. **E-health**: E-health is the use of information and communication technologies (ICT) for health.

4. Health Information Management Practice: HIM practice is described as the procedure that indicates the steps involved in performing health information management functions effectively.

End Notes

1. Y, Alotaibi, and F. Frank. “The Impact of Health Information Technology on Patient Safety.” **Saudi Medical Journal** 38, no. 12 (December) 2018; 1173–80. https://doi.org/10.15537/smj.2017.12.20631.

2. P.M.M, Manohara *et al.*. “Standard Electronic Health Record (EHR) Framework for Indian Healthcare System.” **Health Services and Outcomes Research Methodology**, January 2021. https://doi.org/10.1007/s10742-020-00238-0.

3. K, Somadatta *et al.* 2018. “Building QFD Model for Technical Education, Students as Stakeholders.” **International Journal of Mechanical and Production Engineering Research and Development** 8, no. 1: 621–34. https://doi.org/10.24247/ijmperdfeb201869.

4. KH, Lee. *et al*. “Effect of Telemedicine for a Prehospital Suburban Emergency Medical Service.” **Critical Care** 12, no. Suppl 2: P341.2018 https://doi.org/10.1186/cc6562.

5. N. Al-Shorbaji.. “Improving Healthcare Access through Digital Health: The Use of Information and Communication Technologies.” **Healthcare Access,** February 2022. https://doi.org/10.5772/intechopen.99607.

6. Iloh, Gabriel Uche Pascal, Abali Chuku, and Agwu Nkwa Amadi. "Medical errors in Nigeria: A cross-sectional study of medical practitioners in Abia State." *Archives of Medicine and Health Sciences* 5, no. 1 (2017): 44.

7. A. H, Turan, and K. Tuğba.. “Health Information Technology Adoption and Acceptance of Turkish Physicians-A Model Proposal and Empirical Assessment.” **Health Informatics Journal** 28, no. 2 (January) 2022; 146045822210960. https://doi.org/10.1177/14604582221096041.

8. I. Ojo, Adebowale and O. Sunday, Popoola. “Some Correlates of Electronic Health Information Management System Success in Nigerian Teaching Hospitals.” **Biomedical Informatics Insights** 7, no. January 2019: BII.S20229. https://doi.org/10.4137/bii.s20229.

9. F. A, Williams, and I. Zachary.“Public Health Delivery in the Information Age: The Role of Informatics and Technology.” **Perspectives in Public Health** 139, no. 5 (February) 2019; 236–54. https://doi.org/10.1177/1757913918802308.

10. Information Gap." **Health Affairs** 24, no. 5 (September) 2005; 1290–95. https://doi.org/10.1377/hlthaff.24.5.1290.

11. J. Amlung *et al.*. "Modernizing Health Information Technology: Lessons from Healthcare Delivery Systems." **JAMIA Open** 3, no. 3 (October) 2020; 369–77. https://doi.org/10.1093/jamiaopen/ooaa027.

12. S, Hansen, and A.J Baroody. "Electronic Health Records and the Logics of Care: Complementarity and Conflict in the U.S. Healthcare System." **Information Systems Research** 31, no. 1 (March) 2020; 57–75. https://doi.org/10.1287/isre.2019.0875.

13. P.M.M, Manohara *et al.*. "Standard Electronic Health Record (EHR) Framework for Indian Healthcare System." **Health Services and Outcomes Research Methodology**, January 2021. https://doi.org/10.1007/s10742-020-00238-0.

14. A, Gabriel *et al.* "Implementing Electronic Health System in Nigeria: Perspective Assessment in a Specialist Hospital." **African Health Sciences** 20, no. 2 (July) 2020; 948–54. https://doi.org/10.4314/ahs.v20i2.50.

15. IFHIMA. (2019). *No Title*. 1–19.

16. O. O, Akinyemi, *et al*. "Qualitative Exploration of Health System Response to COVID-19 Pandemic Applying the WHO Health Systems Framework: Case Study of a Nigerian State." **Scientific African** 13, no (September) 2021 e00945. https://doi.org/10.1016/j.sciaf.2021.e00945.

17. I.T. Adeleke, *et al*, "Information Technology Skills and Training Needs of Health Information Management Professionals in Nigeria: A Nationwide Study." **Health Information Management Journal** 44, no. 1 (March) 2020; 30–38. https://doi.org/10.1177/1833358315044001O4.

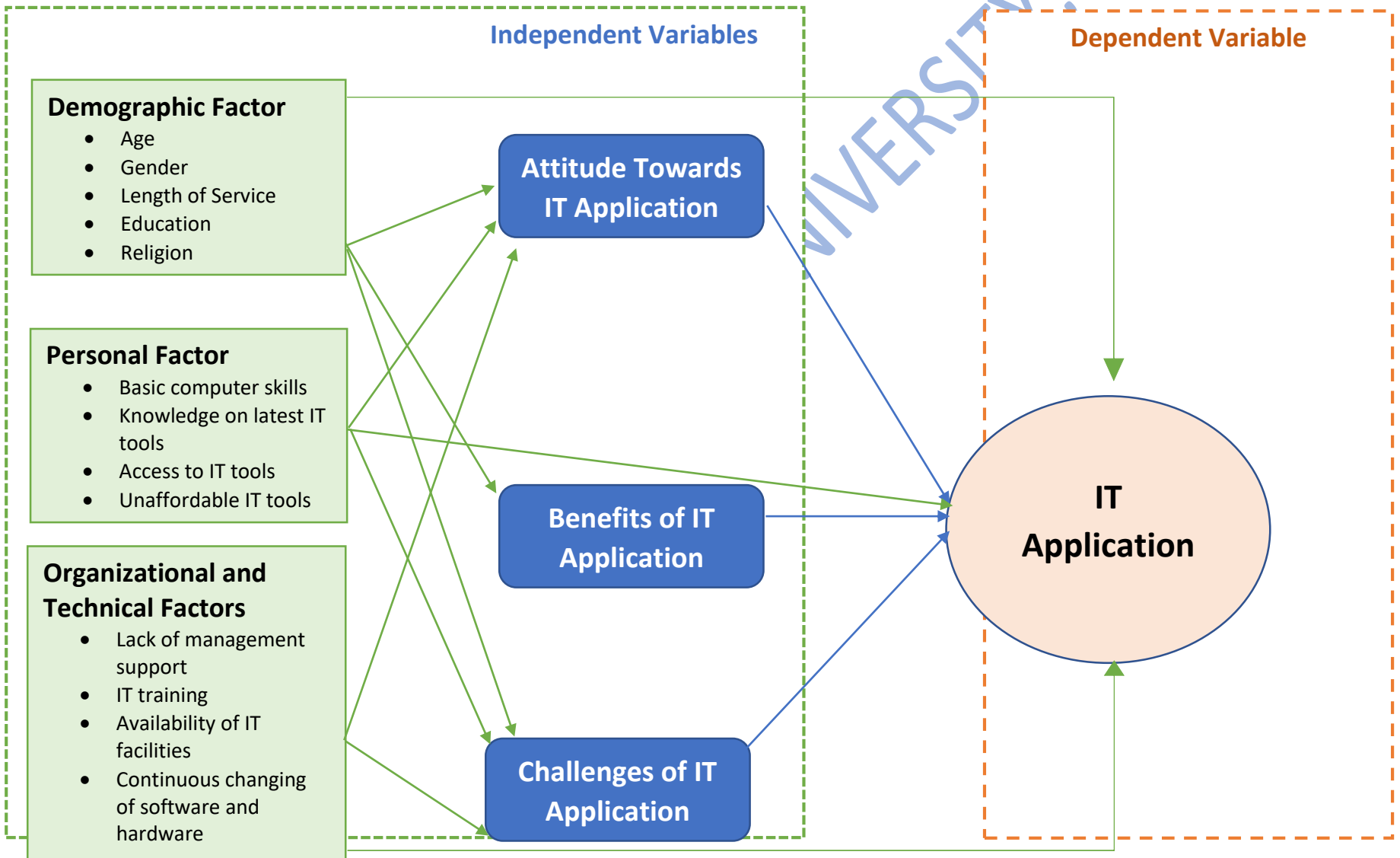
Chapter Two

Literature Review

2.1 Introduction

This chapter aims to present the review of related literatures on the key variables in this research. Many scholars had attempted to give meaningful definitions to the term information technology (IT). They had also examined the in-depth contributions of IT to the development of health care delivery services. In addition, they had proffered meaningful solutions militating against the effective implementation and adoption of IT and this had reduced these impediments and hindrances which led to higher acceptance of the effective implementation of IT in healthcare services. Some of these their observations and definitions shall be reviewed in this chapter.

Conceptual Model



2.2 Global Overview of IT Application in HIM Practice

The widespread adoption of information technology (IT) brings many potential benefits to health care. At the same time, problems with IT can disrupt the delivery of care and increase the likelihood of new, often unforeseen, errors that affect the safety and quality of clinical care and may lead to patient harm. Our capacity to reap the benefits of IT and manage new threats is contingent upon understanding how IT problems can disrupt care delivery and pose threats to patient safety[1]. Nowadays, the progress and development of countries are measured by the extent of their use of information technology (IT) systems to provide services to the public. This is because IT has the potential to perform the given tasks properly, swiftly, within an appropriate time frame, and cost-effectively. Hence, it can be seen that the use of information technology (IT) in healthcare is of paramount importance, to promote the quality of healthcare services and to make access to these services equal to all[2]. The use of information technology in many industries and various problems with the health record management system in Nigeria have been the subject of numerous reviews that have been made and published to date[3]. Because of the industry's focus on improving the delivery of evidence-based care, lowering medical errors, escalating concerns about patient safety, and the growing number of regulatory requirements placed on healthcare providers, the adoption of health information technology has become a top priority[4]. There are a number of issues with the health records in most Nigerian medical facilities, particularly hospitals. These issues have had an impact on the utilization and accessibility of health information in those facilities' treatment of patients who have health challenges because the information required for each patient is either not timely accessible or not even available[5].

Information technology has potentially contributed to the improvement of patient safety, professional efficiency, and patient satisfaction in healthcare[6]. For instance, studies have confirmed that digitalized physician order entry systems that support decision-making greatly

reduced the rate of medication error by over 50% and also that implementation of electronic medical records significantly brings positive returns on investment. Consequently, a lot of effort has been directed to the adoption and application of Information Technology in Healthcare, especially in information management practice[7]. Although a growing body of evidence indicates that the transition to electronic health information is having a predominantly positive effect on healthcare outcomes, equally compelling evidence suggests that many health IT implementations fall short of achieving their potential. However, a critical question remains why do projects that essentially follow implementation recommendations and best practices still all too often fail to achieve the intended benefits[1?]

The efficient administration of data storage and record retrieval is crucial to the high standard of service provided by healthcare institutions. In keeping with this, the system used to maintain records in any healthcare organization should be able to offer intelligent search functions, immediate and multi-location access, and the capability to virtually integrate data elements stored in geographically dispersed databases as this is the only reliable way to ensure better healthcare delivery[8]. Therefore, the recent adoption of EHR in healthcare delivery strives to fulfill the aforementioned functional objectives. Despite these features, EHR in the healthcare sector also aims to overcome the inherent issues with paper-based record management systems, which have been utilized in the field for more than a century.

Introducing information technology to health record management systems covers a range of applications, in line with needs on both a personal and social level[9]. By converting all information flows that were previously based on paper documents into an electronic format, information technology improves administrative process efficiency while minimizing expenses.

2.3 Information Technology (IT)

The definition of information technology in 2022 Information Technology Trends is "everything connected to computing technology. The phrase IT as a whole includes things like the Internet. In the same way, networking, software, and hardware for computers[10]. Information technology (IT) in healthcare[7] is the use of computers, storage, networking, and other physical equipment, infrastructure, and processes to create, process, store, secure, and exchange all forms of electronic data. The creation, upkeep, and use of computer software, systems, and networks are all included in the term IT. They are used for data processing and delivery, among other things. Data is defined as information, facts, statistics, etc., compiled for use, storage, or analysis.

The following is a list of the elements that make up information technology (IT):

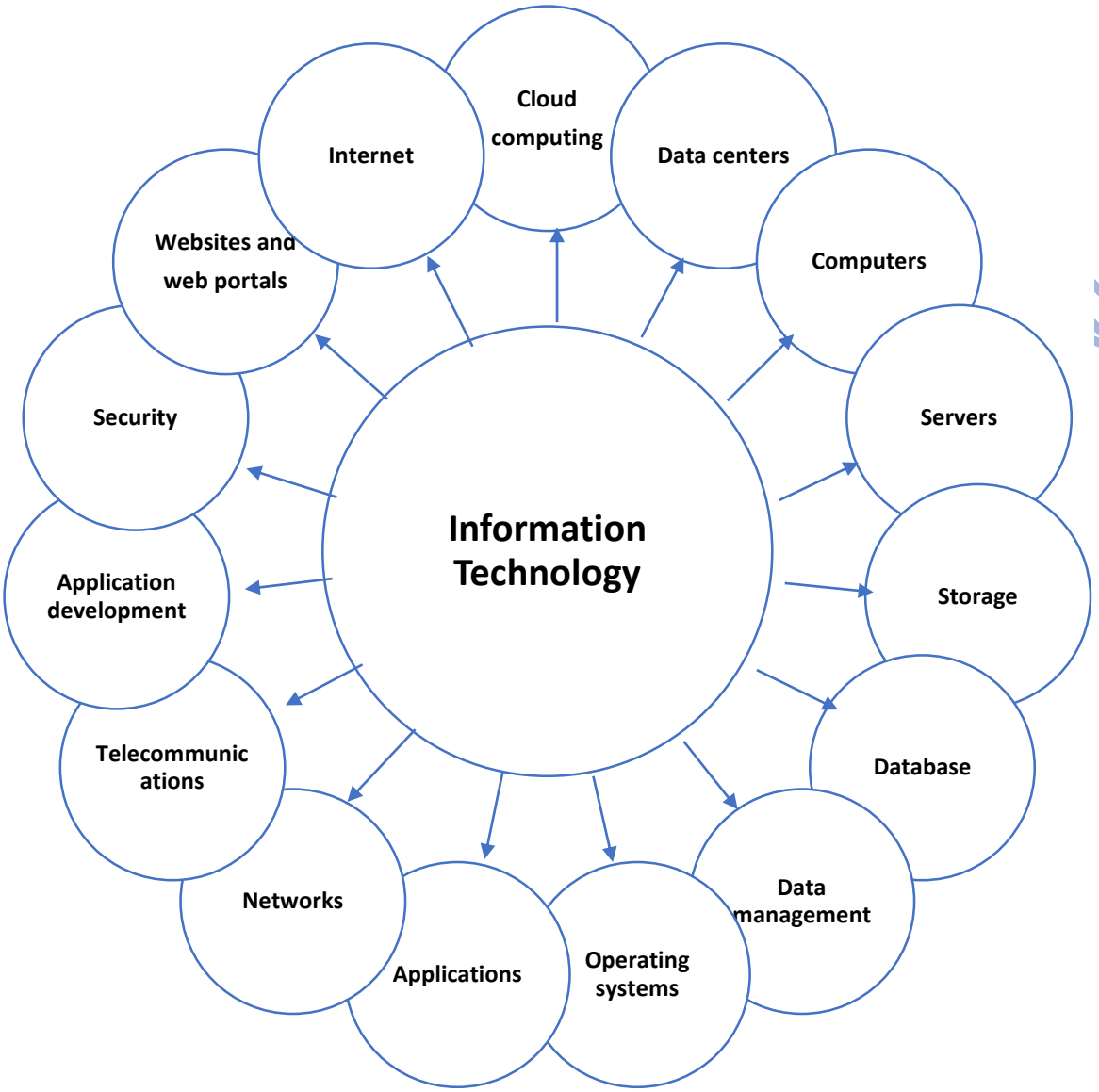


Figure 1: Components of Information Technology

Source: Information Technology Trends, 2022

2.3.1 Elements of Information Technology (IT)

Information technology, particularly in the context of HIM practice as a whole, relies on four main components that are fundamental to the healthcare system. These include software development, database and network management, technical support for computers, and information security[11].

2.3.1.1 Information Security

Information security refers to a collection of procedures used to protect data from unauthorized access or modification both during storage and transmission from one system or physical place to another. Keeping information secure has become more crucial since knowledge has grown to be one of the most valuable commodities in the 21st century. The term "information security" is occasionally shortened to "infosec." Information securities are the procedures and techniques created and used to guard against unauthorized access to, use of, misuse of, disclosure of, destruction, alteration, or disruption of confidential, private, and sensitive information or data in print, electronic, or any other media. Information security is governed by a few laws and principles[12].

Principles of information security: The so-called CIA triad—confidentiality, integrity, and availability—best sums up the fundamental elements of information security.

i. Confidentiality: When one think of information security, confidentiality may be the component of the triad that springs to mind first. Data is confidential when only those individuals who have been given permission to access it are able to do so; in order to preserve confidentiality, one must be able to track down and prevent unauthorized users from accessing the data. Techniques for ensuring secrecy include passwords, encryption, authentication, and security against penetration assaults.

ii. Integrity: Data integrity refers to keeping data accurate and guarding against improper modification, whether unintentionally or on purpose. Since a hacker can't change data they can't access, many confidentiality-ensuring techniques will also protect data integrity. However, there are other tools that help provide a defense of integrity in depth: checksums can help you verify data integrity, and version control software and regular backups can help you restore data to a correct state if necessary. Integrity includes the idea of non-repudiation as well; it must be demonstrated that one can keep the data's integrity.

iii. Availability: it is the polar opposite of confidentiality. One need to make sure that no one can access the data without authorization, ensuring that anyone with the right permissions may do so. A solid backup strategy must be put in place for disaster recovery, and network and computing resources must be matched to the level of data access you anticipate.

2.3.1.2. Management of Databases and Networks

Network administration is the process of using a network management system to administer, manage, and operate a data network. Modern network management systems constantly gather and analyze data, push out configuration changes for enhancing performance, reliability, and security, and use software and hardware to do so. It entails setting up a network's components for monitoring and, if necessary, changing them for maximum efficiency, little downtime, appropriate security, accountability, and flexibility.

Every modern software program depends on data, and databases are the most popular method of storing and managing the data that programs need. A database administrator's (DBA) methods for data storage, operations, and security are referred to as database management. Data from a computer may be organized, stored, and retrieved thanks to database management. A database management system (DBMS) is a piece of software that makes it

simple for users to administer databases. Database management entails developing, implementing, and managing stored data in order to optimize its value. It enables users to view and interact with the database's underlying data. These operations might be as simple as data queries or as complex as creating database schemas that significantly alter the structure of the database.

The Basics of Databases

DBMS is a crucial part of every organization's database management system. Depending on the particular DBMS and the needs of the companies, the size, complexity, and feature set of a DBMS will vary. Before settling on a single system, enterprises must thoroughly assess the DBMS software because different DBMS offer distinct feature sets. A well-configured DBMS, however, will make managing and maintaining databases of any size much simpler.

Advantages of DBMS

DBMS was mainly developed to address fundamental problems with the management, storage, evaluation, security, and auditing of data in conventional file systems. The use of DBMS has the following advantages:

i. **Enhanced Data Security**: DBMS allows for user administration and policy enforcement for security and compliance management. The database security is increased and the data is less susceptible to security breaches thanks to limited user access.

ii. **Efficient Data Sharing**: DBMS permits users to safely access the database from any location. As a result, individuals can quickly complete any database-related work without the need for complicated access procedures or concern over database security. Additionally,

DBMS enables efficient cooperation among different users when they interact with the database.

iii. **Data Integration**: Instead of managing disparate databases as independent entities, DBMS enables users to acquire a centralized view of databases dispersed across various places.

iv. **Abstraction and Independence:** A database management system (DBMS) enables users to change a database's physical structure without altering the logical schema that controls database interactions. Organizations are able to scale the underlying database infrastructure as a result without having an impact on database operations. Additionally, any modification to the logical structure can be made without having an impact on the applications that use the databases. The majority of databases come with built-in backup and recovery utilities.

v. **Simplified Backup & Recovery Procedure**: However, DBMS provides centralized tools to make backup and recovery functions more easily accessible, improving user experience. With features like automated snapshots, backup scheduling, backup verifications, and several recovery options, data security is now simpler than ever.

vi**. Consistent Management & Monitoring:** DBMS offers a single interface to complete all management & monitoring duties, reducing database administrators' effort. These duties can include auditing and reporting in addition to database development and schema changes.

2.3.1.3. Technical Support for Computers

Computer technical support is a service that is tasked with providing assistance to customers in order to identify and resolve problems with any kind of electronic device, whether they are logical (software) or physical (hardware) in nature. In order to provide consumers with a

high-quality service, the employees must be specialized. On the one hand, they must offer technical assistance to customers and assist in resolving particular issues with various equipment.

2.3.1.4. Development of Commercial Software

Software utilized for business operations is referred to as business software. It is frequently used more precisely in reference to software that makes it easier for a company to implement certain business principles in order to achieve particular goals.

Health Information Management Practice

The planning, creation, and maintenance of the best possible healthcare depend heavily on the availability of high-quality healthcare data[13]. The quantity and caliber of information provided to medical practitioners during patient care affects the result and consistency of care. Additionally, especially in emerging nations, the amount of medical information required for clinical decision-making keeps growing. However, the arrangement and accessibility of medical information are still inadequate, frequently leading to poor judgment and medical blunders[13]. Systems for managing electronic health information (EHIMS) are therefore viewed as being essential for improving access to and administration of medical data[39]. Acquiring, reviewing, and maintaining digital and traditional medical knowledge are all part of the discipline of health information management (HIM), which is crucial to the caliber of patient care. Information technology, industry, and science are all present. The system utilized for keeping and exchanging health information in a digital environment is related to the technology of the health information component. For the management and storage of patient data, these include working with software and hardware[3]. According to[14], a health information management practice is a process that outlines the procedures necessary

to carry out health information management tasks successfully. They emphasized once more that practice is different from the idea, goal, or set of norms that underlie an action. Practice is the actual usage or performance. The term "health information management" (HIM) refers to the process of gathering and analyzing healthcare data in order to give knowledge for decisions on patient care, institutional management, healthcare policy, planning, and research. As responsibilities grew from managing paper records to managing the full scope of the process of gathering and exchanging electronically acquired information among diverse institutions thus, the name of the position changed from managing medical records to managing health information. In hospitals, office clinics, health department, insurance companies, and other facilities that provide health care or involve the maintenance of health records, health information management is the practice that involves the maintenance and care of health records using both conventional (paper-based) and electronic methods. With the widespread computerization of health records and other information sources, such as hospital administration tasks and data on health human resources, health informatics and health information technology are being used more frequently in information management techniques in the health sector[15].

According to[16] expressed further regret that the act of handling patients' health records is a problem that has accumulated over time in Nigeria and many poor nations, causing a number of problems. These are simply due to the fact that medical records serve as a platform for recording patient health history and are important in encouraging medical care. They came to the conclusion that effective record-keeping requires the work of top managers and intermediate managers who can coordinate the complex world of hospital information and that the new generation of record managers will exacerbate the challenges of handling patient health records in hospitals, government agencies, and organizations in African countries through education and training[3]. The health information system integrates data collection,

analysis, monitoring, and use of the information necessary to improve the quality and efficacy of health services through improved management at all levels of health care, depending on how it is perceived[17]. It refers to any kind of centralized repository of data, knowledge, or experience that can be utilized to aid or facilitate the delivery of healthcare.

Professionals in health information management create health policies, construct information systems, and pinpoint present and future information needs. Additionally, they use informatics to collect, store, use, and transmit information in order to satisfy the administrative, professional, ethical, and legal requirements of maintaining records for the provision of healthcare. Clinical, epidemiological, demographic, financial, financial reference, and coded healthcare data are used in their work. The proper collection, management, and use of information within healthcare systems "will determine the system's effectiveness in detecting health problems, defining priorities, identifying innovative solutions, and allocating resources to improve health outcomes." In the United States, health information administrators are said to "play a critical role in the de-livery of healthcare through their focus on the collection, maintenance, and use of quality data to support the information-intensive and information-reliant healthcare system." The primary objective is still, however, to gather, manage, analyze, and use the information that is crucial to patient care and make sure that the providers can access the information when required[17].

Another research was conducted by[16] and documented management issues at two healthcare facilities in Lagos State, Nigeria. Their research found that certain hospitals had unequal approaches to handling patient records as a result of insufficient funding, a failure to implement electronic health information programs, a lack of implementation of records preservation and conservation policies, and a low level of health information management as a result of these factors. In a related study by[18] evaluated the contribution of record

management to secondary health care delivery at designated state hospitals in Osun State, Nigeria. Their research's conclusions showed that the lack of a uniform management policy, a lack of legal authority for the disposal of records and documents, lack of funding for the purchase of standard filing shelves and cabinets, and lack of consideration on the part of hospital administrators were to blame for the misfiling, mislaying, overcrowding, and insufficient storage space in a few state hospitals. The adoption of electronic health records in secondary healthcare facilities in Nigeria: Perspectives and Challenges was studied by Attah[51]. He submitted that health care records are important to healthcare wellness. Another scholar, also argued that high quality healthcare data plays a crucial role in optimal healthcare, preparation, growth and maintenance.

The management of medical records, which includes, but is not limited to, a written account of the patient's diagnosis and care, including the history of the condition and the complaints, the doctor's observations, as well as the results of laboratory tests, protocols, medications, and treatment protocols, is necessary for handling health information. Health information management practices, according to academics are essential for ensuring that healthcare facilities are transparent, accountable, secure, and comprehensive.

The act of assessing the value or worth of a specific good, or the judgment or opinion of people regarding a subject are all defined as assessments in the Longman Dictionary of Contemporary English from 1984. The design of the manual or computer information system for gathering, recording, storing, processing, accessing, and displaying data, as well as the aptitude and follow-up of the individuals involved in each stage of these activities, all affect how accurate the data is. The accuracy of the information is the responsibility of everyone involved in collecting or using it. The Data Quality Management Model by AHIMA outlined four essential procedures for data accuracy and this includes:

Application: The reason the data are being collected.

Collection: this entails the process through which data elements are gathered

Warehousing: the processes and systems used to store and maintain data and data journals

Analysis: the process of turning data into knowledge that can be used as an application.

In order to maintain accuracy and efficiency with regard to patient healthcare services provided in hospitals and on the job, each aspect is examined using 10 different data characteristics.

- Data should be easily accessible and legal to collect.
- **Comprehensiveness**: All necessary data items are included. Make certain that all relevant data is gathered, and note any deliberate limitations.

• **Consistency**: Across applications, the value of the data should be consistent and reliable. Data should be current and have currency. If a datum value is valid at a particular time, it is said to be up to date. It is out-of-date if it was true at one point in time but turned out to be false later.

• **Definition**: Explicit definitions should be given so that both current and future users of the data will understand what the data mean. Each data point ought to be well-defined and have reasonable values.

• **Granularity:** The data's attributes and values should be defined to the appropriate level of specificity.

• **Accuracy**: Data values should be precisely the right size to support the application or process. Relevance: The information is pertinent to the operation of the procedure or application for which it was gathered.

• **Timeliness:** Timeliness is determined by the context in which the data are used and how they are used (29).

2.4. Responsibilities of Health Information Management

According to the World Health Organization's research, the roles within the scope of health information management are as follows:

1. **Medical coding**: For best compensation, medical coding involves accurately assigning medical codes. It also entails ensuring that all medical data are accurately diagnosed in accordance with the prescribed course of action.

2. **Medical Necessity**: Medical necessity describes the reasonable and essential procedures, services, and treatments for a disease. The medical audit board analyzes the therapy provided to a patient and determines whether it is medically required based on standards of care. The health information practitioners are responsible for ensuring that medical records are accessible to the board. This is required since the majority of insurance companies won't pay for treatments that are not deemed medically essential according to accepted standards of care.

3. **Support for the medical staff**: A significant part of health information management involves giving physicians with information about the patients they are treating as asked and checking the data for compliance with state, federal, and private insurers' policies.

4. **Assembling Medical Records**: Each medical record should be put together so that it can be used in ongoing medical treatment. This includes creating a precise, legal record,

transcribing medical reports, submitting information for reimbursement, and making the record accessible to authorized parties who need it.

5. **Upkeep of Medical Records**: Upkeep of medical records for patients entails making sure that the records are accurate and easily accessible to allow for continuity of care over the course of the patient's lifetime.

6. **Filing**: The structure of a health information system must be created in such a way that it is easily available, well-organized, preserves patient confidentiality, and is compliant with all applicable regulations.

7. **Privacy and Security**: Every healthcare organization, whether public or private, must continue to discover ways to safeguard the privacy and security of patient information in light of the growing use of information technologies in healthcare. All healthcare providers have a duty to continue training and informing their staff about patient information privacy. By ensuring that the patient's health information is appropriately stored, secured, and only given to the right patient, confidentiality of the patient's health information is preserved.

8. **Information Release**: Numerous factors, including insurance requirements or treatment continuity, may necessitate the request for patient information. With the patient's or their authorized representative's correct consent, health information can be swiftly released in any healthcare establishment.

2.4.1 Professionals in Health Information Management

Professionals in health information management design information systems, create health policies, and pinpoint present and future information requirements. Additionally, they employ informatics to meet the administrative, professional, ethical, and legal record-keeping needs of the delivery of healthcare by gathering, storing, using, and transmitting information[19]. The appropriate gathering, management, and use of information within healthcare systems "will determine the system's effectiveness in detecting health problems,

defining priorities, identifying innovative solutions and allocating resources to improve health outcomes." They work with clinical, epidemiological, demographic, financial, reference, and coded healthcare data. To support the information-intensive and information-dependent healthcare system, health information administrators are said to "play a vital role in the delivery of healthcare in the United States through their focus on the collection, preservation, and utilization of quality data." Health information management is undergoing a change from old management approaches using paper to more effective electronic management, such as Electronic Health Records, as the profession expands and information technology plays a more significant role in the medical world (EHRs). However, the primary objective is still to manage, analyze, and use the information that is crucial to patient care and to make sure that the doctors have access to it when they need it[19].

To ensure that health information programs adhere to medical, legal, and ethical standards, professional health information managers manage and build them. They are essential to the upkeep, gathering, and analysis of data that doctors, nurses, and other healthcare professionals use to offer high-quality care. To ensure that the patient's medical records are accurate and readily accessible when needed, health information managers must collaborate with other subordinates[20].

There are traditional and non-traditional settings for Health Information Management Professionals to work in. Managing a HIM medical records department, cancer registry, coding, trauma registry, transcription, quality improvement, information release, patient admissions, compliance auditor, physician accreditation, utilization review, physician offices, and risk management are examples of traditional settings. In contrast, non-traditional contexts can be found in consulting firms, governmental organizations, legal firms, insurance companies, prisons, long-term care institutions, pharmaceutical research centers, and IT and medical software businesses.

Professionals in health information management provide quality service. Quality is defined by the[21] as consistently addressing the needs of the client (patient)[22]. Additionally, a product must conform to a set of client standards in order to be fit for its intended use.

Nevertheless, "Peter Scholes" introduces the distinction between effectiveness (doing the right things) and efficiency (doing the right things), but[23] investigates quality from the supplier's point of view while quality perception is that of the customers. Quality, in fact, is doing the right thing, doing it the right way, doing it the first time, and doing it on time, while quality in perception is delivering the right product, satisfying our customers' needs, meeting our customers' needs, meeting our customers' expectations, and treating every customer with integrity, courtesy, and respect. Any difference between the former and the latter can result in a problem between the two[24]. Process control is necessary for quality. Quality can only be achieved by continuous improvement of not only the production of products and services but also the design, planning, development, service delivery, purchasing, administration, and in fact all aspects of the transaction with the customer's/care; patient's all must work together towards the same goals. This enables us to exceed our customers'/patients' expectations and it allows us to restore pride and loyalty in our organizations. Only the consumers' or patients' eyes can reveal quality. The first stage is to learn what the client expects from you in terms of effectiveness; after that, you must exceed those expectations in terms of efficiency. Being able to communicate effectively will be crucial because doing so will ensure that you achieve all of the criteria for quality. According to[25], the health care sector has seen a proliferation of innovations aimed at improving life expectancy, quality of life diagnostic and treatment choices, as well as the effectiveness and efficiency of the health care.

2.5 Keeping Records While Providing Healthcare

The development of hospital record management as a fundamental discipline in the field of hospital administration in recent years is evidence that the issue of record keeping in the delivery of healthcare services is tremendously essential[26]. To be effective, the record system must make it simple to locate and view necessary data, evaluate it, and share it with coworkers and other users who are not directly involved in patient care[27]. Any healthcare delivery facility has two main ways to maintain track of patients' medical records: a paper-based system and an electronic health record (EHR) system.

2.5.1 Medical Records System Using Paper

In order to help physicians, remember important information when they next met the same patient, the typical paper-based medical record emerged in the nineteenth century as a highly individualized "lab notebook" that they could use to record their observations and intentions. The demands for information exchange among healthcare professionals, the financial and legal complexities of the contemporary health care environment, the growth of chronic care needs from an aging population, and medical errors associated with handwritten notes have overwhelmed the traditional paper-based approach to clinical documentation[28] Additionally, it has other drawbacks such a lack of storage space for the cards in cases of a large number of patients, inconsistent handwriting, and susceptibility to termite or other infestations. When patients must transport these paper-based data from one hospital unit to another, retrieving patient information will take a lengthy time and they risk learning personal information[26]

Additionally, some people registered with many healthcare providers, and the records of these patients are never shared with other doctors, laboratories, or hospitals. As a result, patient care is disrupted, delayed, and subject to error due to fragmented information[29] Most of the time, patients lack access to accurate and trustworthy information that they may use to

meet their needs. According to studies, individuals are better able to manage their illnesses or diseases when they are informed about their condition and actively participate in decision-making with their doctors[30]

According to[26], compared to digital documents, paper records require a lot more storage space. Records management (RM) has been defined as the management and supervision of documents, whether they are paper or digital, regardless of format[7]. It covers the creation, acquisition, maintenance, use, and disposal of records. In order to help physicians, remember important information when they next met the same patient, the typical paper-based medical record emerged in the nineteenth century as a highly individualized "lab notebook" that they could use to record their observations and intentions. In this sense, a record is any content that captures a commercial transaction. In many hospitals around the world, the conventional manual paper-based health records are used in different ways. As a result, policies on the preservation of paper-based and electronic records management vary between industrialized and developing nations. For instance, many US states mandate that physical records be kept on file for at least seven years. When paper records are kept in multiple locations, it takes time and effort to gather them in one place for a health care professional to review; in contrast, electronic records will make the process simpler. The costs of storing paper-based information per unit of material, such as paper and video, are significantly higher than those of electronic storage media. These still hold true, especially for person-centered papers, which are difficult to manage and inefficient if not electronic (thus difficult to centralize or federate). Large medical institutions are actively supporting the adoption of electronic medical records because shipping, copying, and faxing paper-based documents can be challenging[35].

2.6 Areas of Application for Health Records Service Information Technology

Applications related to health record services like the ones below could be computerized:

A. Patient Master Index, Section A (PMI)

All patients who have visited or been admitted to a hospital are listed in the patients' master index. Remember that just the bare minimum information is required to identify the patient; clinical details are not contained in this file. A computerized file would be cumulative, just like a manual file is. In other words, the file would constantly be updated with new patients. Previous patients' information is retained on file for future attendance, admission, or other reasons, so they are not removed. A computerized PMI system should have a master file with patient information and the software that permits access to the patient data in the file. The "Patient's Record" refers to the information in the master file and can be retrieved directly by using the following methods: the patient's hospital number, family name only, complete name, and any other approved identity information, such as a national identification number

Over time, the following steps would be taken to create this master file:

Information already stored on index cards from the manual card system is entered.

c) Registration as an inpatient

d) Registering as an outpatient.

When a new patient registers as an outpatient or is admitted as an inpatient, their registration into the system is complete. So that the details of a new patient are readily available, the file indexes ought to be updated concurrently. In order for recent admissions, address changes, etc. to be quickly available on the "patient record," information on current patients should

also be updated on attendance. Every change made to the patient's master file should be recorded by the system so that it is clear what was modified, when, and by whom.

Strict security codes should be applied while retrieving data to prevent unauthorized access and modification.

B. Admissions, Transfers, Discharges, and Death (ATD)

The implementation of such a system would allow employees to keep track of all patients who are already admitted, are waiting to be admitted, have recently been discharged, or have passed away. Additionally, it would give users in the hospital direct access to the file (through a terminal) and automatically produce bed censuses and other daily statistics needed by the hospital administration.

The goals of such a system would be to: • Offer an inpatient booking service for patients waiting to be admitted; • Maintain records of bed state and bed allocation; • Locate patients for inquiries; • Provide daily patient census reports and related statistics; • Provide information for the patients' master index (directly linked to the PMI system); • Offer a comprehensive database for all users of patient identification and location information.

C. Index of Diseases and Procedures

To support a hospital's research function, a computerized disease and procedure index needs to be created. This system might include coded information on diagnosis and procedures that would make it possible to retrieve specific cases for analysis. The ATD system could be used as the foundation for the records, to which disease and procedure codes are added after the completion of the patient's health record at discharge or upon death. For a later analysis of the use of hospital services, this system could also store data pertaining to tests completed while in the hospital.

The discharge section of the ATD master file is processed by this suggested program. In such a system, the discharge area's pertinent records are obtained. However, it is important to set a deadline for moving from the discharge area to the disease/procedure index. The recommended minimum transfer period is seven days.

1. Coding: Using the international classification of disease (ICD) and classification of surgical operations, coding is the process of assigning alphanumeric codes (numbers and alphabets) to medical conditions and operations in accordance with predetermined criteria (CSO). Clinical diagnoses of patient illnesses are coded using predetermined standards.

The HIM codes the primary diagnosis and procedure, and then uses a terminal to insert the diagnosis/procedure code numbers into each patient's admittance record.

2. Retrieval: The system might be made to enable the retrieval and report production of data on the various illnesses and procedures to be treated at hospitals, with information retrievable by illness, procedure, sex, age, physician, linked illnesses, and hospital number.

There could be four files in the system:

• Tables master file, which includes ICPM procedure codes and rubrics as well as ICD9 disease codes (or relevant classification systems in use)

• Episode master file, which includes information about each inpatient episode (admission episode)

• User file for health records, which includes user names, passwords, and type

• Doctor Master file, which includes the names of all attending physicians' files

2.7 Applications Commonly Used for General Purpose in HIM Practice.

• Microsoft Word is a word processing program that can be used to type documents, from straightforward letters to visually appealing newsletters that are used as a form of communication in a hospital setting.

• A spreadsheet tool called Microsoft Excel can be used to keep track of lists, figures, and statistics.

• A database tool called Microsoft Access can be used to keep track of a variety of connected but unrelated data, including patient data, patient billing data, patient entry order data, and product inventories.

• Fully animated computer and informational presentations can be created using Microsoft PowerPoint, a presentation tool.

• Corel Draw is a window-based graphics design program used to electronically arrange text and graphics. Furthermore, it's employed for intricate drawings, logo design, cover pages, etc.

Statistical Package for Social Science is known as SPSS. One of the most well-liked statistical tools, SPSS, can manipulate and analyze data in a highly complex manner as well as produce tables and graphs. All of the analyses discussed in the chapter as well as many more can be carried out using SPSS, which can manage massive volumes of data.

2.8 Digital Health Solutions

A variety of digital health solutions are used to increase patient access to care.

To improve access to healthcare, a range of digital health solutions are being used.

Access to healthcare services is made possible by a wide range of technological choices. The most frequently used eHealth/digital health app categories are listed below. These include:

1. Electronic Health Record

An electronic health record (EHR) is a database of information on a person's health condition that can be processed by a computer and is primarily gathered to assist the provision of integrated, comprehensive healthcare to that person[31]. The data may also be used for further objectives that advance the general public's health, subject to legal limitations and with the patient's consent. The EHR is one of the healthcare technologies that has endured while also developing. Every electronic health system is built on it, and it defines how well digital health services work in a company or even a country. The objective of EHR systems, which exist in a range of forms and sizes, is to collect, store, exchange, and use patient and third-party health data in accordance with the relevant legal and ethical frameworks. Due to the complexity of the record's structure, compliance with semantic and syntactic standards, the interface, open vs. commercial suppliers, language version, and many other challenges, the deployment of EHR systems to enable access to healthcare services is challenging. Healthcare facilities may decide not to use such technologies for a variety of reasons.

2. **Telemedicine**

Although telemedicine is not a brand-new concept, the coronavirus (COVID-19) epidemic has utilized the technology extensively over the past two years. It is not acceptable at this time to discuss the history of telemedicine as a technology and a means of enabling remote access to medical care. "The only purpose of telemedicine is the provision of health care services where distance is a significant barrier, by all health care professionals using information and communication technologies for the exchange of reliable information for the diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for

the continuing education of health care providers for the improvement of individuals' health and the health of their communities[32]. Because telemedicine is focused with providing healthcare to an individual, even though telemedicine and telehealth are distinct ideas they can be used interchangeably.

Telehealth, on the other hand, focuses on providing and monitoring healthcare to a population. In their systematic review[33] noted that "telehealth can become a basic need for the general public, healthcare professionals, and patients with COVID-19, especially when people are in quarantine, enabling patients to in real-time through contact with a healthcare provider for advice on their health problems[14]. Without requiring the patient or individual to be in the same place or room as the healthcare expert, telemedicine offers the potential to provide timely, secure, and more inexpensive care. Simply put, this means that a patient can access healthcare services without having to go outside of their current area. This kind of service was made available to patients in order to prevent them from coming into touch with medical personnel who might have tested positive for COVID-19 and to protect the continuity of their primary, secondary, and, in certain cases, tertiary care. Telemedicine services are now accessible to guarantee prompt access to high-quality knowledge and care. These services consist of measures for disease detection and diagnosis, public health support, a way for patients to interact with other patients, family members, and healthcare professionals, and a more sophisticated form of support that includes support for eLearning for both care providers and recipients[33].

3. Internet-Based Health

Several concepts can be used to represent information that is available and transmitted via the Internet. One of these is the web, which is referred to as "a techno-social system that allows individuals to engage over technological networks, thereby improving individual

cognition, communication, and cooperation[34]". Additional Internet applications include social networking platforms and email services, for instance. Users of health information have found that these programs are easy to use, available in a variety of languages, and frequently Healthcare Access 10 relevant to their needs. Users now have more control over what is posted and searched for online thanks to the shift from Web 1.0 to Web 4.0, which makes use of natural language processing. When web designers or owners personally connect with users, the validity, timeless nature, and potential exploitation of online predators are called into question[67].

4. **Cellular Health (mHealth)**

The field of medicine and public health known as "mHealth" benefits from mobile technology, which includes smartphones, the Internet, patient monitoring equipment connected to smartphones, personal digital assistants (PDAs), and other wireless devices. Users of any digital technology, such as patients, careers, pharmacists, or other healthcare professionals, are included in the definition of mHealth assistance in addition to the devices mentioned above[35]. The top six uses of mobile phones for health are toll-free emergencies, health call centers, appointment reminders, community mobilization, information dissemination, mobile telehealth, emergency management systems, and mHealth applications, according to the WHO global survey[36]. Smartphones and other mobile communication devices are designed to run software programs known as mobile APPs. Additionally, they might be accessories for smartphones or other mobile communication devices, connected devices, software-only add-ons, or a combination of both[36].

5. Huge Data

Huge data large datasets that are frequently or automatically gathered and kept electronically are referred to as "big data" in the context of health. It is reusable in the sense that it consists

of data that can be combined and connected with other databases already in existence in order to improve patient health and the efficiency of the healthcare system. It does not refer to data compiled for a specific study[37]". By using big data to identify trends and forecast diseases, medical researchers and healthcare professionals can better understand the distribution of diseases in a country or community. When used successfully, big data can contribute to the development of sustainable healthcare systems.

Collaboration will improve care and outcomes and eventually increase access to healthcare. It should be highlighted that the majority of medical data that is relevant for therapeutic purposes is unstructured and dispersed over a range of sources, including individual electronic medical records (EMR), lab and imaging systems, physician notes, medical correspondence, claims, etc.[38]. The idea of big data is used in conjunction with data analytics, which is emerging as a potential subject for gaining understanding from extremely large data sets and improving outcomes while reducing costs. Big data has the power to fundamentally alter how healthcare is delivered[39]. Analysis of health care's cost-effectiveness, efficiency, sickness prevalence, and accessibility have been impacted by the study of data science and the growing importance of data as a health resource.

6. Systems for Geographic Information (GIS)

Health Geographic Information Systems (GIS) Ignorance about their availability, the distance between one's home and the institution, and the cost of taking a car there are some of the biggest barriers to receiving health care services. Five potential benefits of integrating GIS in healthcare IT are listed by Brown[40] and include identifying health trends, monitoring the spread of infectious diseases, using personal technologies, combining social media, and improving (health) services. According to Brown's conclusion, GIS is a powerful tool that has been successfully used to address a variety of significant health challenges, from disease

management to improved services. Finding the nearest medical facility and the most efficient route there has become easier thanks to the application of geolocation technologies in the field of health. Thanks to the integration of geographic data components (locations) and thematic data in a database, it is now possible to locate the area where a specific type of health care service is provided. In addition to meeting the needs of the research community for data accessibility, "GIS plays a critical role in identifying where and when to act, improving treatment quality, boosting service accessibility, finding more cost-effective delivery modes, and ensuring patient privacy".

7. Internet of Things (IOT)

A network of physical items called the Internet of Things (IOT) uses connectivity to allow data exchange[27]. Thanks to the Internet of Medical Things, patients can now provide their own health information to specialist centers for monitoring while still at home or anywhere else (IoMT). Thanks to a combination of medical devices and applications that can connect to health care information technology systems via networking technologies, patients can still receive health care services made possible by technology without having to leave their current location. Wearable technology comprises health monitoring devices that can be worn on the body. This kind of equipment has spread more widely throughout the tech sector as businesses have started to grow. As corporations have started to create more wearable devices with cutting-edge sensor technologies that can capture and transmit information about their surroundings, this type of device has become more common in the digital industry. A wearable device is widely used to track a wearer's vital signs, health and fitness-related data, location, etc. These might include continuous glucose monitoring equipment, smart bandages, smart medicines, remote patient monitoring, patient movement monitoring, and nutritional systems. Medication adherence enables people to take their medications on time

and even warns medical professionals if they don't take them as directed. Wearables have numerous advantages for consumers, but they also have many advantages for healthcare professionals. For instance, they speed up the process of gathering real-time health data while also making it simpler for people to access healthcare services. A lot of elderly patients, persons with chronic diseases, and patients who are advised to stay at home owing to logistical or budgetary reasons receive home care and monitoring, even though access to health services is made feasible by digital health tools. Hospital-to-home healthcare (H2H) has been the go-to method for delivering medical treatments as the healthcare delivery system has developed.

8. Health Artificial Intelligence and Machine Learning

According to a 2017 World Health Organization report[17], 400 million people still do not even have access to the most basic medical care and services. Artificial intelligence (AI) implementation is only hampered by the need for significant financial backing, despite the fact that it can reduce this number. One of the reasons for this situation is that patients are unable to access healthcare services due to a wide range of social health factors. AI enables many people who cannot access health care to be contacted "virtually" through image identification and interpretation, diagnostic support, creating reminders and alerts, and therapy planning. AI offers numerous benefits to both patients and the healthcare system. It reduces costs, provides quick and accurate diagnoses, and reduces human error because the patient can receive medical care without going to hospitals or clinics. AI assistants, among other things, allow patients to add their data more frequently via online medical records and provide online treatment. Through telemedicine services, which allow professionals to assist patients who reside in remote areas, they also support patients' virtual presence. Using a remote presence robot, doctors can communicate with their staff members and patients in

clinics or hospitals to provide assistance or respond to their questions. The "Ethics and Governance of Artificial Intelligence in Health" guidelines from the WHO have just been released[68].

9. Medication Administration Using a Bar Code

Electronic systems known as bar code medication administration systems integrate electronic drug administration data with bar code technology. These systems help to avoid medication errors by making sure the right patient gets the right medication at the right time. Furthermore, the sophistication of the various existing barcode systems varies. When drugs with similar sounds or appearances might be mistaken for one another, for instance, some software generates alarms. In addition to providing clinical suggestions for specific prescriptions when they are scanned, other people can assist with documentation (by noting drug administration in the eMAR and other important clinical information).

10. Electronic patient portals

The use of patient portals increases the efficiency of preventative care, illness awareness, and self-management, according to numerous studies[34] A secure web application called a patient portal enables two-way electronic communication between patients and their healthcare providers as well as access to the patients' private health information. However, there is no evidence that they result in improved patient safety outcomes.

11. Support For Clinical Judgment

Clinical decision support provides the healthcare professional with information and patient-specific information. With the intention of influencing their choice, this information is intelligently filtered and presented to the healthcare professional at the appropriate times. Clinical decision support consists of a number of tools that enhance clinical workflow and decision-making. Clinical recommendations, condition-specific order sets, patient-specific clinical summaries, templates for documentation, support for investigative and diagnostic procedures, and other resources are among them. notifications, warnings, and reminders for patients and healthcare providers

2.8.1 Electronic Health Records (EHRs) in Healthcare Delivery

Electronic health records are used when information technology (IT) is used in all of the aforementioned domains (EHR). The term "Electronic Health Record" is frequently used in numerous nations, though definitions and the scope of coverage may vary. Today's environment accepts it as longitudinal health record entries made by medical professionals at various locations where care is offered.

EHRs are described as a longitudinal collection of electronic health information for and about individuals from various organizations and industries that relates to a person's health[17].

The current definition of an EHR in the USA contains all data found in a conventional health record, including behavioral and environmental data and a patient's health profile. EHR also has a temporal dimension, which enables the incorporation of data from numerous episodes and providers, eventually resulting in a lifetime record[7].

Systems that handle patient data go by a variety of abbreviations, including Electronic Medical Record (EMR), Electronic Patient Record (EPR), Computerized Medical Record

(CMR), Computer Based Patient Record (CPR), and Electronic Health Record (EHR). Depending on the defining nation of origin, health sector, professional specialty, and time period, there are a few slight changes in the meanings[41]. In this investigation, EHR is preferred. It is widely agreed that the electronic health record is a significant factor in modern organizational productivity, efficiency, and performance effectiveness in healthcare delivery[42]. The EHR can be characterized as a longitudinal health record that contains entries made by medical professionals at various locations where care is delivered. It is largely used for creating goals, arranging patient care, documenting the provision of care, and evaluating the results of care. It contains details about the needs of the patient during a period of care delivered by various healthcare experts[43]. The early 1970s saw the development and introduction of the first EHRs[44]. An EHR is a record that contains many types of data. Personal information, medical histories, allergies, test results, a history of medications taken, immunization status, and even some audio and visual (CT image) data are all included in the data.

According to[26] an electronic health record system (EHRs) is described as a centralized array of individual patient or community electronic health information. There is a digital record that can potentially be shared among different healthcare settings. Data from EHRs may include billing information, ethnicity, medical history, prescription and allergy information, immunization status, laboratory test results, radiological images, and vital signs. Healthcare providers use electronic medical records (EMRs) or electronic health records (EHRs), HIT systems that primarily operate at the organizational level, to monitor and update patient health information, submit physician orders, and track outcomes, findings, and treatment. According to[3]. Although the terms "EMRs" and "EHR" are often used interchangeably, the Health Information and Management Systems Society (HIMSS) asserts that EMRs are the official medical records of a health care system and cannot be utilized with other

organizations. EHRs, on the other hand, support inter-organizational operability[7]. This chapter frequently uses the term "EHR" to refer to any type of program since the operability spectrum for EHRs is still at the organizational level in the United States and because it is becoming more common in literature to refer to both EMRs and EHRs as "EHRs." The four main elements of an EHR are described by the[80] as follows: (1) the clinical evidence; (2) a recording of results; (3) registration of a medical order.

EHR is a digital repository of patient data that is accessible by multiple authorized users, safely kept and exchanged, according to the International Organization for Standardization (ISO). The EHR is often referred to as a "longitudinal electronic record of patient health information created by one or more interactions in any care delivery context" by the Healthcare Information and Management Systems Society (HIMSS). More than just a data repository, it "supports various care-related tasks, including evidence-based decision support, quality management, and outcomes reporting, directly or indirectly. The electronic health record (EHR) is viewed as the framework for integrating a variety of information tools (such as telemedicine, emergency information, test ordering, electronic prescriptions, decision support systems, digital imaging, and emergency information) that could enhance the incorporation of evidence into clinical decisions. Utilizing such data in routine clinical practice might result in a healthcare system that is safer and more effective[45]. Numerous advantages of EHR for patients have been documented internationally[46]. One of the main advantages mentioned is the improved quality of care as a result of patients' vital health information being available to their various providers, which can greatly enhance care coordination and boost the effectiveness of primary care practices. The EHR could enable citizens to actively participate in decisions regarding their health and could be used to track the delivery of advised preventative treatment across primary care practices, based on pertinent disease management programs[47]. By giving healthcare workers pertinent, timely,

and up-to-date information, the EHR is also a tool that promotes knowledge sharing and decision-making[48]. Electronic coding, electronic indexing, computerized patients' master index (also known as database management system), and telemedicine are common EHR features utilized in Nigerian healthcare facilities. While some hospitals have implemented a whole EHR system, others only use one or a few of its features. For instance, Lagoon Hospital currently has a fully computerized system, whereas UCH only utilizes a portion of the electronic health records system.

Each of these elements possesses a variety of traits that might or might not be present during system functioning. Most of the first three elements listed above are covered by at least one organizational unit in basic EHRs[7]. EHRs that are comprehensive or completely functional are equipped with every module's feature set. In the United States, the deployment of these systems has been slow. Because electronic health records are more efficient than manual ones, experts in many healthcare settings have pushed for their use. Authors have looked at ways to overcome social and technological barriers to the use of electronic health records in Saudi Arabia's public and private institutions[7]. According to these writers, Nigeria and other developing countries do not have a national comprehensive electronic health information platform. Additionally, they noted obstacles, calling for their reduction if electronic health records were to be maintained. These obstacles included social, technical, and financial ones. Kalra also looked at the requirements for a long-lasting electronic health records system. He emphasized that the deployment of electronic health systems records is the only way to meet the growing demands of clinical care on the health care workers to obtain patient health information as quickly as feasible[3]. Electronic health records may soon become a standard in the majority of public health settings worldwide, according to a similar study by[3] Employees and patients can use electronic health records to learn more about their medical histories and other clinical data pertaining to their health and welfare.

Waegemann put forth five stages of EHR development in 1996.

First level: Automated Medical Record (AMR): About 50% of patient data are still generated and saved by computers, which are subsequently used to print out paper records.

Second level: Computerized Medical Record System (CMRS): In a digital scan method, older records can be accessed since they perform the same role as a paper record. However, users cannot arrange the data however they choose, for instance, the information cannot be formed into an image.

Third level: Electronic medical records (EMR): The data range in EMR is identical to that in the second level, but the data can be structured. Realizing interoperability inside a facility is the goal of EMR. The following characteristics of EMR: Provide a common workstation for all applications and services, recognize all patient information in a single institution, and make patient information available to all medical care providers.

Fourth level: Electronic Patient Record System (EPRS): In patients' medical records, more details are kept. It did not only cover a restricted range of time and geography, but also contained all medical information pertaining to a single individual.

Fifth level: The electronic health record, or (EHR), is the fifth level. The larger definition of electronic medical records includes behavioral data that is provided by parents, caregivers, clinical workers, self-collection, and life traditions in addition to the standard health information utilized in medical agencies.

The fourth and fifth stages, according to Waegemann's prediction, will be attained in 2002. But up to this point, not even the nations with the most advanced medical information technology have lived up to Waegemann's claim. These nations made significant investments

in creating accessible EHR. The American Recovery and Reinvestment Act (ARRA) in the United States allocated up to $34 billion for the approved EHR systems' meaningful use[49].

2.8.2 Feature Capabilities of the EHR

In order to promote higher safety, quality, and efficiency in the delivery of healthcare, a committee of the Institute of Medicine of the National Academies in the United States has specified a set of eight fundamental care delivery functions that electronic health record systems should carry out[50]. They consist of:

1. **Data and Information About Health**

Certain patient information must be included in an EHR. This information is necessary for doctors and other healthcare professionals to make crucial clinical decisions. In order to guarantee improved access to at least some types of information needed by care providers when they need it, EHR systems with a defined dataset that contains items, such as medical and nursing diagnoses, a medication list, allergies, demographics, clinical narratives, and laboratory test results, are necessary[50].

2. **Results Management**

The practitioner can more easily access computerized results at the time and location where they are required; the shorter time lag promotes efficiency and patient safety by enabling speedier identification and treatment of medical issues. Additionally, electronic results can facilitate improved interpretation and make anomaly detection simpler[51].

3. **Order Entry/Order Management**

It enables healthcare professionals to enter orders (for things like medications, lab tests, radiography, and physical therapy) electronically rather than on paper. It has been

demonstrated that using computerized order input in conjunction with an electronic health record increases clinician productivity[52]. By removing lost orders and ambiguities brought on by illegible handwriting, producing related orders automatically, keeping an eye out for duplicate orders, and shortening the time it takes to fulfil orders, this functionality helps enhance workflow processes[53].

The newest drug information is provided, a patient's allergy to a medication is cross-referenced, and alarms for drug interactions and other potential patient difficulties are detected by the computer. Clinical decision support helps the physician make decisions about patient care[54].

4. **Electronic Connectivity and Communication**

EHR systems ought to permit interaction between care partners including the pharmacy, radiology, and the lab. Effective communication is essential to provide high-quality healthcare to patients, other members of the healthcare team, and other care partners, while a lack of it can increase the risk of adverse outcomes[50].

5. **Support for Patients**

EHR systems enable patient education. Patient education has shown to be very useful in improving control of chronic illnesses, and computer-based patient education has been found to be effective in primary care[55].

6. **Administrative Procedures**

Electronic scheduling programs for hospital admissions, inpatient and outpatient operations, and appointments should be included in EHR systems[50]. This will improve the effectiveness

of healthcare organizations and enable them to serve patients more effectively and promptly[56].

7. **Reporting and Population Health Management**

By making it simpler to gather standardized, systematic data in a manner that can be shared across many healthcare organizations, EHRs can enhance reporting and surveillance. This can help public health organizations better track, stop, and manage disease, leading to better population health outcomes[57]. For instance, in New York City, public health officials created a platform that uses EHRs to send clinicians public health notifications[58].

2.8.3 The Evolution of EHR

Early work: Academic medical centers, the government, and the industry have all created various sorts of electronic health records. It is difficult to gather the patient's medical records into one area where they may be easily handled and seen. Early efforts to construct the electronic health record (EHR) started in the 1960s and 1970s when academic medical centers created their own systems[13]. Chemical information systems were the name given to the earliest systems. One such product was created by Lockheed in the middle of the 1960s and has since been passed down to vendor technicians, TDS healthcare, and Eclipsys, which is now a component of all scripts. Because of its quick processing and adaptability, it had an impact on later systems that could support a large number of user[13].

One of the first clinical decision support systems, health assessment via logical processing (HELP), was being developed at the same time at the university of Utah in partnership with 3M. Then, in 1968, Massachusetts General Hospital started using computer-stored ambulatory records (COSTAR). COSTAR was created in partnership with Harvard and had some innovative elements. The system could be divided into components thanks to its

modular design, and its database recognized several words for the same sickness, allowing users to identify a certain ailment throughout the health system despite changes in terminology at various institutions[13].

Leaders began creating groups to address the bigger concerns that would promote the widespread adoption of electronic medical information in the 1980s after realizing the advantages of industry-wide standards. Increased efforts have been made since the 1980s to employ EHR more frequently. The Institute of Medicine[50] recognized the need for a thorough examination of paper medical records and began such a study in the middle of the 1980s. The findings were published in 1991 and again with revisions in 1997. The argument for using EHR was made for the first time in this report, which also suggested a method for transitioning paper records to electronic records. It was listed as one of the seven main suggestions for improving patient records. Additionally, it pointed up impediments to EHR adoption (such as a lack of standards, security concerns, or cost) and recommended both private and public funding for their creation. The computer-based patient record institute (CPRI), which later combined with the health information and management systems society, or HIMSS, helped remove impediments to the creation of electronic medical records as a result of the IOM's recommendations[13].

The IOM concluded in a study on medical errors titled "To Err is Human" published in 2000 that the implementation of technology like computerized physician order input would make healthcare safer. The IOM has also assisted in the creation of the health level 7 (HL7) electronic standard organization[46]. Building a safer healthcare system. Error is human. 1999 in Washington, DC. The most well-known international, nonprofit standards-developing organization (SDO), founded in 1987, is called HL7. It creates electronic standards to ensure that the EHR's components can communicate more easily. Because an electronic EHR system

frequently consists of components from numerous different vendors, standards that outline details like the computer language that each component will use are crucial for its proper operation. Since 2006, vendors have been certified as HL 7 compliant by a regulatory body called the Certification Commission for Healthcare Information (CCHIT) (http://www.cchit.org visited June 15, 2021).

EHRs have surfaced in the political discourse at the national level, reflecting widespread worries about how keeping records may affect public health. President Obama included EHR in his American Recovery and Reinvestment Act of 2009 as part of the Health Information Technology for Economic and Clinical Health Act, while President Bush brought up the subject in his State of the Union address from 2004. (HITECH). The provost of the Lagos State College of Medicine (LASUCOM), Professor Olumuyiwa Odusanya, believes that in the Nigerian context, the time has come to establish healthcare services with local content by making e-health a necessary component for the delivery of high-quality healthcare services. At the 53rd annual general conference and delegates meeting of the Nigerian Medical Association (NMA), held in Lagos, Nigeria, Dr. Osahon Enabulele, president of the NMA, described e-health as a safer, secure, ethical, and cost-effective transmission and exchange of health data and information. He also noted that some of the common e-health applications include m-health, telemedicine, and EHR.

2.8.4 Application of Free and Open-Source Electronic Health Records (EHRs)

Open-source goods have been created in the healthcare industry to enhance healthcare while keeping costs below those of comparable proprietary products. It creates "a key opportunity for the promotion of effective systems by enhancing clinical engagement in software development, fostering innovation, improving system usability, and reducing costs and should, therefore, be central to a sane Healthcare Information Management System (HIMS)

procurement strategy," claim Reynolds and Wyatt. Several EHR system development projects have been carried out in numerous nations[93].

In the United States, just 5% of hospitals used Computerized Physician Order Entry (CPOE) through 2005, while roughly 23.9% of physicians used EHR in the ambulatory setting. Simply a few US hospitals had a complete electronic clinical information system, according to a study on the levels of EHR adoption in the country, while many more only had partial electronic records systems. Policymakers appear to need to provide financial support, interoperability, and training for IT support workers in order to increase the use of EHR in US hospitals. Veterans' health information systems and technology architecture refers to the comprehensive organizational health information system that the U.S. Department of Veterans Affairs (VA) as a government sector has been working to construct since the late 1970s (VistA). Vista employs MUMPS, a program that can be used for illness case registries. MUMPS is a utility multi-programming system from the Massachusetts General Hospital. In the USA, only a select few significant commercial sector companies engaged on the adoption of EHRs[59].

Another nation looking for technological solutions to provide access to high-quality healthcare is Canada. These solutions also bring about brand-new difficulties, particularly in terms of acceptable norms, technology selection, crossing conventional jurisdictional boundaries, privacy, and secrecy. In order to create an effective EHR in Canada, numerous projects were planned. One of these initiatives is Health Infoway. The Canadian federal government established Canada Health Infoway as a non-profit organization in 2000. This organization's initial goal was to hasten the implementation of EHR across Canada by 2007. It aims to link businesses engaged in EHR projects and encourages them to create and distribute "knowledge objects" that may be applied by other businesses. The 1.1-billion-

dollar Canada Health Infoway is a significant investment for Canadians. This would enable decisions about diagnosis and treatment while promoting more effective delivery of healthcare, patient confidentiality, and quick access to comprehensive and accurate patient information. A sustainable healthcare system with improved quality, accessibility, productivity, and cost savings would be the end outcome[59].

England's EHR is provided by the National Program for Information Technology, which is run by the National Health Service (NHS). In 2005, the NHS set up an EHR system. By 2010, it was planned to offer each of the 50 million NHS patients a personalized electronic NHS Care Record Service (NHSCRS). The local NHS sites would securely share each person's comprehensive records among themselves using the NHSCRS. Each patient is given a special identifier by the system. Patients would be able to make their Summary Care Record (SCR), a summary of their critical medical information, accessible to authorized NHS professionals throughout the NHS in England. Additionally, they would use the safe website "HealthSpace" to access their SCR. In 2006, it was predicted that this project will cost 12.6 billion British Pounds. This exceeded expectations by roughly two times since the project's inception. The project was anticipated to end up costing more than 20 billion pounds[59].

In the Asia-Pacific area, numerous regional and national EHR programs and systems have been created. Health Information Technology (HIT) is regarded as the cornerstone for enhancing the standard of healthcare, safety, and governmental effectiveness in Australia, the forerunner of EHRs. In the late 1990s, general practitioners were urged to install software packages for clinical data transmission and prescription. Health Connect is a project of the Australian, State, and Territory Governments to move paper-based health information to electronic health records (EHRs) for the benefit of patients and healthcare professionals. By doing this, healthcare personnel would have faster access to and more secure sharing of

patient information. This program's primary goals were to increase access to life-saving information in crises and to enhance the quality and safety of health information by using a common electronic health record (SEHR). The task of creating a design for SEHR is under the purview of the National E-Health Transition Authority (NEHTA). The Australian, state, and territory governments provided funding for NEHTA in 2005 to create national EHR standards and infrastructure[70]. The advantages of OSS use in the health industry have been the subject of numerous studies. The properties of OSS systems have been contrasted in a number of studies. Many nations have embraced the use of OSS in national health systems in recent years as a solution to the challenges of installing proprietary EHR systems as well as the need for EHR systems to improve healthcare services[59].

Because the electronic record system is still being fully implemented for records management reasons in many developing nations, hospitals, especially public hospitals, do not use information technology to ensure the smooth functioning of control and administration of patient information. So, depending on the system and healthcare settings, it may be conceivable to employ hand-writable mobile devices in addition to a workstation to read and write health information to a patient using an EMR. Individual notes from an EMR are easily accessible to consumers and usable thanks to Personal Health Records (PHRs), which are made possible by access to electronic medical records (EMRs). Some EMR systems automatically manage clinical incidents by processing patient data from an electronic health record to anticipate, monitor, and potentially prevent adverse events. These could include medication instructions, radiological reports, laboratory results, and any other information from ancillary institutions or notes from doctors. They could also include discharge/transfer instructions[3].

Electronic records were defined as "information generated electronically and stored using information technology" by the South African National Archives and Records Service in 2006. "Electronic records are often digital copies of transactions made by people or businesses[59]". A digital record that is created, managed, shared, and kept through the use of ICT is known as an electronic record. Without electronic health records, the usage of temporary cards nowadays frequently has a negative impact on the delivery of healthcare services, according to[27]. Similar to this, the[35] asserted that the health information system serves as the foundation for decision-making and has four basic tasks, including communication and utilization: data generation, collecting, interpretation, and synthesis. Health surveillance toolkit for enhancing health information technology is a document that[35], The WHO divided the metrics used to measure the quality of a country's health information system into two broad categories: 1) Data collection metrics using key sources and methods (patient surveys, civil registration, censuses, recording of services, and resource monitoring in the health system); and 2) Country capacity indicators for the synthesis, analysis, and validation of data. The ability of the nation to gather pertinent data at appropriate intervals and to employ the best data sources is reflected in the generation of data. Benchmarks consist of the ability of the nation to gather pertinent data at appropriate intervals and to employ the best data sources is reflected in the generation of data. Benchmarks include the regularity, promptness, and caliber of data collection efforts as well as the accessibility of crucial indicators. On the other hand, measures of a nation's ability to evaluate the key aspects of its institutional framework, such as freedom, accountability, and access, are necessary to guarantee the accuracy of data. Benchmarks include having access to microdata and metadata as well as different communication topologies. The research demonstrates that health assessments, birth and death registration, census data, records of health services, and resource tracking are among the data sources for adequate health information. Additionally,

institutional mechanisms that are in place and functioning and are in charge of assessing health statistics, combining data from different sources, and validating data from facilities and the general public serve as data sources for synthesis, analysis, and confirmation capabilities. It went on to say that the health information system collects data from the healthcare industry and other relevant fields, analyzes the data, and guarantees its general authenticity, correctness, and timeliness., and transforms data into health decision-making information.

2.8.5 Structure of EHR

Every efficient EHR system has three structures, according to[60]: Direct care functions

1. Infrastructure for Information and Supporting Roles

EHR direct care functions Individual patients are cared for using direct care duties, which are primarily related to routine clinical tasks. Care management, clinical decision support, and operations management & communication are examples of subsets of direct care functions. Authorized healthcare providers are anticipated to be the main consumers of these functions[94]. The tasks include diagnosis, creating management objectives for the patient, organizing and executing interventions, and reviewing and assessing outcomes[61]. Along with past medical history, referral, treatment, medication, and discharge[43], it also includes alerts that prompt for contraindications and incorrect prescriptions of medications to patients[60].

2. The Assistance Role

Supportive functions are those that help with the delivery and improvement of care but typically have no bearing on the direct care of a specific patient. These activities support public health and medical research, help with administrative and financial aspects of healthcare delivery, and raise the standard of care internationally. The support staff are the

primary users of this function, however in some cases, it may be necessary to expect the healthcare practitioners to carry out specific administrative tasks[60]. Optimizing patient bed assignments, providing health guidelines and resources, assigning administrative and financial codes, electronically checking local immunization registries to make sure a child is currently registered and determining the child's immunization status, and providing information about where providers are located within the facility are a few examples of these support functions.

3. Purpose of the Information Infrastructure

This function specifies the system heuristics required for trustworthy, secure, and interoperable computing. Although these tasks are unrelated to the delivery of healthcare, they are important to guarantee that the information system provide protections for patient safety, privacy, and information security, as well as operational efficiencies and interoperability minimal standards. On behalf of the end-users, these tasks are anticipated to be carried out transparently by EHR system apps[60]. The system administrator is anticipated to be involved in all processes involved in setting up and running the EHR system. Security, business rules management, workflow management, registry and directory services, information and record management for health records, standard terminology and terminology services, standards-based interoperability[60]

2.8.6 The Different Types of Electronic Health Records (EHRs)

It can be confusing when people discuss what has been developed in various institutions and used as an electronic health record. In some cases, it may be a longitudinal record widely accessible across many institutions, but in other cases, it may be a limited automated system only available within a confined community or within a particular unit or department. Determining the kind and scope of the electronic health record system your organization

wants to employ is crucial[38]. The transition from a manual or paper record to one created electronically in one form or another has been referred to by a variety of names over the years. Automated health records (AHR), electronic medical records (EMR), computer-based patient records (CPR), and electronic health records (EHR) are a few of the most commonly used terminology[6].

1. Automated Health Records

It is collection of digital photographs of conventional health record materials has been referred to as automated health records (AHR). The images of these documents are often kept on optical disks after being scanned into a computer. Early in the 1990s, document scanning onto optical disks received the majority of the attention. However, it did not address data input/output at the patient care level. Instead, it addressed access, space, and control issues connected to paper-based records.

2. Electronic Medical Records (EMRs)

These are widely used by general practitioners in many developed countries and contain information about patients' identities, prescription drug information, laboratory results, and in some cases, the full range of medical data that the doctor records during each patient visit. In certain nations, like Korea, the word "EMR" is used to describe a hospital's electronic record system, which in addition to the foregoing also includes clinical data input by the healthcare provider at the point of service[6].

3. Computer-Based Patient Record (CPR)

CPR was first used in the USA in the 1990s. This was described as a set of health records for a single patient that were connected by a patient identification. A single episode of care for a patient or details about medical care provided over an extended period of time could be

included in the CPR[16]. Early CPRs concentrated on tasks including sending out medical alarms, prescribing medications, and delivering integrated patient data from nurses, laboratories, radiology, and pharmacies. The emphasis on sharing health information was restricted to inpatient hospitals, despite the fact that this type of computer-based patient record was deployed in a number of settings.

2.8.7 Features of Electronic Health Records

The following features of electronic health records are listed by the California Healthcare Foundation (2008):

1. Definition: An electronic patient health record that may produce a comprehensive account of a clinical patient interaction. Includes patient demographics, conditions, prescriptions, vital signs, medical history, immunizations, notes, laboratory data, and radiology reports.

2. Individual patient-based approach; when overly elaborated, might serve as a legal patient record (and eliminate the need for a paper chart). Population management and population-based reporting are not optimized; modification is necessary.

3. Documentation and Reporting: Tools and templates for significant volumes of clinical data are used in the electronic documentation of patient visits, even those that do not take place in an office. calls for the planned movement of data from paper charts. A range of structured or coded data are used to enable reporting, analysis, and search.

4. Encourages team care: Encourages team care (including messaging between team members). Frequently "task-driven," defining the procedures and follow-up actions that staff members must take for specific patients.

5. Integration Level: Practice management systems may be integrated. to issue assessment and management codes, as well as to assist billing procedures more generally.

6. Support for electronic lab ordering and results reporting is also supported, either as a separate module or linked with the EHR.

7. Level of sophistication and Support: More advanced technology calls for more reliable implementation and support services.

8. Implementation and Maintenance: More complicated and costlier to maintain are longer implementation schedules.

9. Training: Significantly more staff and physician training is necessary, as well as improved computer literacy.

10. Influence on workflow Processes: Significantly more significant (requiring more modification) impact on workflow processes; typically necessitates intensive provider computer use.

Other characteristics include: (1) The capacity to take rules and standards into account and remind providers about the proper required care

(2) Quick access to pertinent information at the time of the patient visit.

(3) Standard and special reporting features assist patient outreach instruments (such as reminder letters or call-back lists).

(4) Data entry and confirmation of acceptable diagnoses require human interaction.

(5) There is typically no management assistance for many co-morbid conditions (relative prioritization of recommendations).

(6) Materials for patient education and instruction are typically only available in English.

(7) There isn't ideal interoperability and it's not built-in.

2.8.8 Predictors for EHR Adoption

EHR adoption rates in the clinical settings under study were also given by the majority of studies. Key elements that were linked to a higher level of EHR adoption among medical professionals are listed in the list below:

(1) Practice Size and Type: EHR adoption appears to be being driven by MDs working in larger groups and being headquartered in hospitals or medical facilities to start with. It has been proposed that this reflects the better accessibility of the financial resources needed at these sites to purchase an EHR system. It was discovered that doctors who practice in regions with greater physician concentration and rivalry were more likely to utilize EHRs.

(2) **Recognition of the advantages:** Core healthcare providers who were actively involved in IT planning or who had a solid understanding of the quality-of-care improvements brought about by EHR use were more likely to be heavy users of EHRs. Adoption of EHRs is also predicted by organizational involvement in quality improvement.

(3) **Technical Preparedness:** Adoption of EHR is positively influenced by positive opinions of the impact of computers on health care and familiarity with current systems. Medical professionals who already use online scheduling and billing systems exhibit less reluctance to changes linked to technology. Higher adoption of EHRs was likely to result from the organization giving IT a strategic priority.

(4) **Medical Specialization**: The more dependent on technology a specialty is, the more likely it is that doctors will be content with changes brought about by technology in the

workplace. According to certain research, compared to specialists, primary care doctors were less likely to utilize EHRs. Additionally, compared to other doctors, general pediatricians adopted EHRs substantially more slowly than they did, while imminent adopters were more likely to work in family medicine or obstetrics/gynecology. The apparent significant attitudes between MDs and specialists about EHRs could possibly help to explain this.

(5) **Age:** EHR adoption is often higher among younger physicians. However, research found that once embraced, they are less likely to become heavy users of EHRs[52]. For some EMR providers, for instance, utilizing computers and similar technologies at work is an entirely new experience.

(6) **Knowledge**: Studies have found that practices that train medical students or residents are more likely to have an EHR, and that residents and recent graduates have more favorable sentiments regarding EHRs[52].

(7) **The Practice Area**: The use of EHRs by doctors who work in urban settings is higher, indicating that the digital divide between doctors in rural and urban areas will likely increase as a result of the adoption of EHRs. Additionally, remote hospitals encounter challenges like decreased support and occupancy rates as well as increased financial and social constraints. Rural hospitals typically do not try to compete with other hospitals to acquire new technologies because they may be the only choice for the local population. As a result, compared to rural hospitals, metropolitan hospitals are more likely to implement EHR systems[88]. Last but not least, network externalities or network effects play a big part in the uptake of EHR. According to the definition of network effects, these are "increased utility for users of a technology that occurs when adoption among other users increases[13]". New doctors' decisions to utilize EHR systems may be influenced by the present degree of physician adoption of these systems.

(8) **Ratio of Patients to Providers:** EHR adoption was more prevalent among MDs who saw less patients, which may indicate that MPs who work in busy offices or hospitals are less likely to embrace EHRs.

(9) **Resources in Money:** EHR adoption was much higher among doctors with larger Medicare patient panels than among those with smaller Medicare patient panels. In a government-funded hospital versus an MD's private practice, different financial considerations apply. Physicians who work in hospitals do not have to worry about the significant issue of initial and ongoing maintenance cost.

(10) **Cooperative Organizational Culture**: Active resistance to EHRs can be reduced by a collaborative culture inside the MD practice. Though it can also prevent criticism prior to and throughout implementation, denying decision-makers crucial input[62].

2.8.9 Advantages of EHR

The EHR's obvious advantages over paper records have contributed to its widespread acceptance in industrialized countries[56]. These opportunities for healthcare organizations include the potential to reduce costs and increase workplace productivity[56], enable access to medical records from remote locations, improve speed and ease of record retrieval, provide ways to flag abnormal results, and do away with handwritten prescriptions, which lowers the likelihood of prescription errors.

1. Enhance Patient Safety and Care Quality

When combined with embedded features like CPOE and CDSS, EHRs have the potential to increase the quality of treatment[11]. According to research, EHR is associated with better patient outcomes in hospitals, such as better disease management, better prescribing practices[97], and better infection control[63]. Similar to this, using computerized prescription

entry, anticipating drug interactions and alerting healthcare professionals, assisting clinicians in reconciling patient medications, and maintaining a thorough and readable medical record can all improve patient safety specifically by reducing medication errors in hospitals[12]. After adverse occurrences take place in hospitals and other outpatient settings, the EHR can assist clinicians in determining their underlying causes[12]. Additionally, EHR can help healthcare professionals quickly recognize and inform specific patients about critical drug therapy adjustments, such those connected to Vioxx withdrawal. Additionally, the EHR alert system guarantees that patients receive the appropriate dosage and drug usage. According to Park, Howie-Esquivel, *et al.* 2015, the EHR could increase patient adherence to recommended medication therapy.

2 Increase Effectiveness and Productivity

The possibility of increased productivity and efficiency increases with EHR implementation. EHRs, for instance, make it easier to avoid manual tasks like filling out specialized datasheets or extracting data from charts. By boosting physicians' workflow efficiency and meeting the information demands of working clinicians, the adoption of EHRs can enhance relationships amongst medical staff members[16]. The scheduling systems can significantly increase hospital and clinic productivity and give patients more prompt service (Alpert 2016). According to a study on EHR, daily work was improved and patient care was improved: (a) medication turnaround times decreased from 5:28 hours to 1:51 hours; (b) radiology procedure completion times decreased from 7:37 hours to 4:21 hours; and (c) reporting times for lab results decreased from 31:3 minutes to 23:4 minutes. The same study found that by shortening the time it took to send paper versions, ordering transcription errors dropped, hospital stays got shorter, and test results got transmitted more quickly.

3 **Boost Communication and Care Coordination**

With current information readily available to all doctors, the EHR enables a patient to be seen sequentially by various providers. It gives the medical professional instant access to diagnostic tests and the opinions of other clinicians[16]. Clinicians can easily coordinate and monitor patient care across practices and facilities with the help of an EHR. In order to provide better care overall, clinicians from various specialties and disciplines also work together on patient outcomes as a team. This is especially true for chronic care management. The system also enables the coordination and scheduling of a patient's required services, such as office visits, tests, surgeries, and hospital visits, throughout the course of a single visit rather than several trips[16].

Additionally, by enabling staff to communicate one another from any workstation, the email capability included in many EHRs helps enhance communication[7]. Clinicians can communicate in real time on shared responsibility thanks to the built-in email feature. This allows for simultaneous work completion and could result in significant time savings[7].

4 **Cost Savings and Increased Revenue**

Wang, Middleton, et al cost-benefit's analysis study from 2003 showed a positive return on investment with the main areas of savings being decreased drug costs, increased utilization of radiology tests, improved charge capture, and fewer billing errors over a 5-year period by comparing data from their installed EHR, other published studies, and expert opinion. Similarly, a different study that looked at the financial impact of deploying a commercial EHR revealed that the system was linked to immediate decreases in spending and gains in income throughout the course of the study. The first-year savings of over $1 million that the EHR was solely responsible for were disclosed. The savings came from decreased transcribing costs, better coding, the removal of the need to create new patient charts, less

space requirements, and cost avoidance from not hiring more full-time chart room staff even though the number of patients had doubled[13].

5 Patient Records' Confidentiality

By limiting physician access, the usage of EHR facilitates improved patient confidentiality and data security[54]. Regulations governing the privacy of patient records set strict requirements on healthcare organizations to safeguard patient data while utilizing electronic methods of communication with other caregivers and patients.

Access to patient information is therefore severely limited because only authorized users are given access to all patient data stored within an organization. Additionally, the EHR offers robust security to safeguard patient record data throughout the entire wired and wireless environment.

6 Enhanced Capacity for Research

Electronic data for EHR systems will enhance the ability to objectively examine patterns and more quickly locate evidence-based best practices[54]. For instance, it is frequently possible to obtain the data required for a study directly from the EHR, making a large portion of the information needed for data collection simply a byproduct of routine clinical record keeping. De-identifying and integrating EHR data into larger data repositories could allow for research to be done to enhance patient safety, medical knowledge, and public health[64].

2.9.10 Implementing EHRS: Challenges

The implementation issues for EHRs in wealthy countries are somewhat different from those in developing countries[56]. The focus of this part will be limited to the difficulties specific to public hospitals in underdeveloped nations like Nigeria due to the research aims of this study.

Over the past ten years, Sub-Saharan Africa has seen a surge in the availability of EHR, however there have been obstacles[13]. And while some private hospitals in Nigeria have fully functional EHRs, government institutions seem to be taking their time deploying EHR and other applicable ICTs that are needed to improve healthcare delivery[13]. The main obstacles to the successful implementation of EHR systems in developing nations like Nigeria include government policy and strategy, a lack of ICT infrastructure, a lack of basic ICT skills and knowledge, poor internet connectivity, financial issues/restraints, and an insufficient electric power supply.

1 **Government Policy and Strategy**

Government regulations may be the main impediment to the use of electronic patient records in Nigeria, according to certain theories[48]. In order to support the adoption of e-health projects in Nigeria, the World Health Organization emphasized the need for a strong government policy on healthcare technologies in 2008[33]. The health of Nigerians has been a priority for successive administrations through a number of national development plans and annual budgets, but in the past, there has only been a limited improvement in their situation[65]. It was said that even the 2001 Nigerian IT policy's execution did not have the anticipated effects on the health sector.

The current strategy, known as the National Strategic Health Development Plan (NSHDP) 2010-2015, was developed through a complex collaborative process involving all significant stakeholders in order to deliver on a shared results framework. Each and every stakeholder will be held accountable for achieving the goals and targets as contained in the results framework.

2 **A lack of ICT facilities**

The infrastructure that already exists in a hospital or other healthcare organization determines how easily EHR can be adopted[51]. Inadequate ICT infrastructure was one of the obstacles to the adoption of electronic health information, according to a prior study[66]. Contrary to affluent nations, most developing nations lack strong healthcare infrastructures and substantial financial support from their governments[52]. Thus, the lack of access to computers and other ICT resources continues to be a barrier to the adoption of EHR

3 A lack of Fundamental ICT Knowledge and Abilities

Any healthcare delivery system should prioritize training, but there is limited data on the degree of IT training and use among healthcare practitioners in underdeveloped nations[13]. While advanced technology like virtual reality, robots, and 3D simulations are used to teach physicians in rich nations, such advanced technologies are not available to their counterparts in developing nations. The efficiency and success of EHR adoption in poor nations may be affected by the practitioners' lack of exposure to sophisticated concepts during their medical education, which tends to expand the gap between them[51]. Although medical professionals in Nigeria may be able to swiftly adjust to the EHR system due to their formal training and availability to personal computers and other devices, the same cannot be said of other support personnel who have had limited access to computers and other ICT facilities.

4 **Insufficient Online Connectivity**

Through efficient data management, image archiving, and communication systems, internet connectivity can revolutionize the flow of information in the healthcare industry. It is especially crucial for the operation of teleradiology and radiological information systems[16]. All of Africa now has direct internet connectivity, thanks to a significant improvement in

access over the past ten years. However, the implementation of the EHR will be hampered by the slow and expensive internet bandwidth in Nigeria[18], as a high bandwidth is needed for the transmission of large images between institutions as well as accessing the EHR itself, particularly if they contain videos and images.

5 **Financial Problems or Limitations**

The implementation of the EHR entails significant financial obligations, including the need to buy appropriate software and hardware, install it, train hospital staff, and maintain it. As a result, governments and institutions may be discouraged from starting such programs. But during the past ten years, as EHR technologies have spread, the initial cost of systems has decreased significantly.

The fact that many financial benefits of the EHR typically accrue to third-party payers in the form of errors avoided and improved efficiencies, which translate into lower claims payment, rather than to the provider (who is required to make the upfront investment), adds to the cost of EHR adoption, implementation, and ongoing maintenance. The adoption and deployment of an EHR are hindered, especially for smaller practices, by the misalignment of incentives for healthcare organizations and significant upfront expenses (Ibid). inadequate supply of electricity

Any nation that struggles to supply its population with Uninterrupted Power Supply (UPS) would undoubtedly struggle to implement quality ICT services like the EHR[43]. Adopting healthcare information systems (EHR) requires an uninterrupted power supply since it prevents unexpected shutdowns that could result in data loss or long-term system damage. In many areas of Sub-Saharan Africa, the power supply is inconsistent or nonexistent. For instance, just a handful Nigerian cities and towns get consistent and dependable energy for

10 hours straight each day. As a result, the majority of Nigeria's internet facilities experience regular outages and equipment damage from power outages[67].

2.8.10 Integration of IT into European HIM Practice

Costs associated with health care are rising as society ages. It is presumable that the digitalization of medical services will result in services that are both more affordable and of higher quality. Any doctor or hospital in Austria can simply access the ELGA electronic medical record system as needed. In Sweden, Denmark, and Estonia, doctors send patients' prescriptions electronically or straight to the pharmacy that fills them[68]. Google and the British NHS are collaborating to use AI in the medical industry. As a result of the emergence of digital technology, including the digitization of processes, products, and services, the industry has undergone a complete reorientation, including its business models. It is anticipated that digitization would make data more accessible more quickly. Paperless data, including a single electronic record and the exchange of medical data, is another benefit of the digital transformation of healthcare. In this situation, all medical institutions should have access to the records and storage of all patient information. Real-time transmission of the electronic appointment and the digital prescription medication to the pharmacy[69]. For example, adverse effects can be automatically checked using recipe data. Despite the long-standing interest in the uptake of health information technology (HIT), numerous studies have indicated that the adoption of IT in the US is still relatively low, at least in some areas. This disparity is further highlighted when compared to other industrialized nations. For instance, only 17% of their American colleagues use electronic medical records compared to 88% of general practitioners in the Netherlands. According to the[50], chronic underinvestment in HIT has led to the poor quality of US healthcare, as shown by these figures.

Inpatient communication with personnel is made possible through the use of IT in healthcare. This incorporates software that enables staff coordination and communication within hospitals. Nowadays, tele-consultation is crucial: methods that enable remote communication between the doctor and patient, particularly for straightforward requests or follow-up appointments. Patients with chronic disorders should be monitored remotely in particular. The monitoring of vital signs in individuals who are at high risk of acquiring chronic diseases is most frequently included. Remote diagnostics are made possible by modern digital diagnostic instruments. The use of bar codes is one of the most recent advances in modern IT in healthcare accurate barcode-based identification and confirmation of each drug prescribed in the patient's particular ward. Tracking utilizing radio frequency identification (RFID) involves spatially locating all assets (such as beds, pricey medicines, and diagnostic equipment). Remote monitoring of vital signs in the intensive care unit is known as "Vital Parameters Tracking" (electronic Intensive Care Unit). Robots that execute repetitive duties (such as transferring drugs or patients) are used in hospital logistics. Using robots to automate processes: Using robotics to carry out simple tasks (for example, monitoring vital signs, and processing samples). Electronic guidance: The following physician receives referral and discharge information (including test and clinical data) for patient consultation. Dashboards to boost performance: To increase the internal accessibility of information about the performance of the doctors, software for controlling patient flow Genetic testing: Based on patient-specific genomic, proteomic, and other data, personalized therapy recommendations are made. Technologies used to treat chronic illnesses[70] Programs for diabetic patients include connected insulin testing devices and reminders to individuals to follow their treatment plan. Patients with respiratory illnesses can access online pulmonary rehabilitation programs and connected inhalers. Heart rate monitors with warning capabilities and connected sensors are being used to educate patients with cardiovascular disorders. Chatbots

used in medicine may be fully automated or managed by specialized software. Applications, virtual trainers, and fitness monitors as disease prevention tools[71].

In Europe, people can arrange appointments with general practitioners (GPs) and specialists using an electronic registration system through online portals. They are linked to the reminder feature as well. The introduction of the digital transformation of healthcare results in a sizable financial cost savings for the European healthcare system. The adoption of unified electronic medical records, which has the potential to save 6.4 billion euros, will result in the largest savings (19 percent). The savings come from the productivity and efficiency gains that follow. For instance, by cutting back on the amount of time needed for administration and the number of pointless duplicate tasks[71]. In rural locations with a dearth of locally licensed medical specialists, the digital platform's virtual features are especially helpful. The use of a tablet to record results is part of the digital approach, which gives nurses and doctors complete access to patient information wherever they are working. The use of IT not only changes how doctors and nurses perform their jobs; it also enables patients to control their own medical care and exchange information with their doctors. Participants in the professional healthcare industry, however, may face major issues. Control is necessary before computerized medical records and prescriptions can be introduced. It is crucial that patients have complete control over the personal data that is created and sent in medical records and that they offer open interfaces between online and offline therapy. It should be underlined that the healthcare sector lacks the tools necessary to guarantee true accountability. For instance, when patients schedule a visit with a doctor, they are not given the chance to learn in advance about the accomplishments or shortcomings of this healthcare professional. Medical businesses require a set of uniform protocols for dealing with patient feedback[54]. Financial transparency is aided by IT use in healthcare.

The sector can use technology to better inform clients about health costs. Digitalization opens the door for novel medical theories and presents chances to address some health issues. Patients are already utilizing digital medical solutions, such as online services and online tools, despite some privacy concerns that still exist. The system may be made more effective and a more integrated strategy can be established by using digital technologies. Despite the ongoing development of new technology, this change is still pending in several regions of the world. IT should be used in healthcare in more ways than just the ways required by emerging technologies. It's also important to draw in experts. In fact, IT has already completely transformed every industry, but in the healthcare field, innovations are helping us live longer, healthier, and more productive lives[71].

A wide range of health information technology is used in hospitals. These systems are built around a core group of useful applications. Health information systems are built on the electronic medical record (EMR). EMRs, which have replaced traditional medical records, methodically gather data about patients' health. Providers can electronically enter prescriptions for patient services and pharmaceuticals using computerized provider order entry (CPOE) capabilities. Direct physician order entry through CPOE lessens the possibility of misunderstandings between various healthcare providers. These technologies also act as a platform for decision assistance features that lower prescribing errors and increase adherence to healthcare guidelines[72]. The operational and other related costs in hospitals have been decreased thanks to IT application in the healthcare sectors, which has also enhanced patient safety and outcome[73]. The physician shortage in both developed and underdeveloped nations has been helped by this application in healthcare. A very clear illustration of how technology that made gathering, storing, organizing, and sharing information easier led to significant change is the advent of Electronic Medical Records (EMRs), Telemedicine, and other e-health applications.

If used effectively, IT has the ability to reduce health care expenditures while creating new avenues for patient care and welfare[74]. Health care workers recognize a number of difficulties with IT installation and underuse in daily operations at the institution, including but not limited to problems with unstable power supply, which is quite one of the core concerns that threatens the full performance of the system. Adopting an IT resource plan without a sufficient power supply is not feasible. A robust healthcare system and non-operational IT infrastructures, including computers and other sophisticated gear and software, are also made more challenging by interoperability.

It is well known how important information technology (IT) is, but few studies have looked at how it influences how services, particularly healthcare services, are delivered[75]. ITs are nimble instruments that can handle any records management job. According to[57], multitasking is one of the key benefits of information technologies because they can quickly solve a variety of health information management-related problems with the use of sophisticated retrieval techniques like query languages, multimedia databases, and database management systems. These tools are effective in enhancing the storage of organizational records and help to increase the scalability of organizational records storage. Contrary to bulky paper records, which require a reasonable amount of physical space, such as records centers and dungeons for storage, an information manager can create, use, populate or distribute, store, and retrieve information on a single computer workstation, thereby eliminating the enormous amount of associated required records management space, stationeries, and filing equipment. There is no issue with inadequate filing hardware or a lack of room. ICTs offer previously unattainable capabilities for handling massive volumes of information[76] who cite this as evidence. It was stated that computer systems can hold a significant amount of company records rather than relying on human information records or handwritten scripts. Through digital and electronic storage devices, IT provide a wide range

of data storage options. A sizable amount of information can be stored on Google Drives and flash drives. Information can be obtained from electronic storage devices at any time by numerous users simultaneously, according to the Library and Information Association of Zambia Journal (LIAZJ). For instance, a doctor can ask a patient to submit to various tests, and all interested healthcare professionals can read the results within the same time frame. This has enhanced productivity and efficiency, making it essential for providing patients with high-quality treatment to continuously update patients' medical condition[76].

Effectiveness and Efficiency, which are made possible via the integration and dissemination of information, are the two important areas where performance can be enhanced through the transformation of health information management practices with the application of IT in hospital administration. Although using IT to deliver effective and efficient patient health care services is seen as crucial[77]. While efficiency refers to how the hospital operates with the goal of providing a higher output for a given set of inputs, effectiveness has to do with how something was done in a way that produced the desired or expected results. Because IT advantages are viewed as unpredictable and because cost, quality, and productivity are the key drivers driving the transformation of the healthcare domain, a significant number of healthcare firms, including hospitals, have not yet made significant investments in IT[77].

A digital transformation is a new strategy for providing care, streamlining procedures, and addressing customer wants for wellbeing. Digital transformation, according to Deloitte, is the use of contemporary technologies to significantly increase an organization's performance or reach. However, the effectiveness of IT in a particular organizational setting and the underlying mechanisms through which it influences results heavily influence the ability of health IT to alter medicine. Modern technologies offer enhanced procedures, engaged personnel, and innovative models in a business that has undergone digital transformation.

Expect a long period to pass and expect your efforts to be scrutinized[78]. As a result, ensuring alignment with results while also proving value along the way takes a careful approach. A variety of electronic methods are used in the management of patient health and healthcare information for both individual patients and groups of patients as part of the transformation of health information management practices with information technology (IT) applications, which helps to improve the quality of care and makes health care more affordable. The spread of the coronavirus disease 2019 (Covid-19), which pushed healthcare systems to the limit of their capabilities[79], can be attributed to the influx of technology companies into the healthcare sector. As a result, more and more services were prepared to be made available to help with Covid19-related issues. For instance, Verily, a Google company, enables the automation of coronavirus symptom screening and offers current, actionable information to enhance community-based decision-making[80]. The pandemic has created an additional opportunity for technology businesses that were previously inactive or prohibited from entering the healthcare sector in this unprecedented situation[81]. Additionally, Amazon offers cloud storage through Amazon Web Services for the Australian government's tracing app's health surveillance data[82], and Amazon Care, a division formerly in charge of handling internal staff care requirements, now works with the Bill and Melinda Gates Foundation to provide US citizens with Covid-19 testing kits[83]

Health care is one of the global indices used to gauge human existence since it maximizes the enjoyment of attainable quality wellbeing and is one of everyone's fundamental rights regardless of racial or ethnic origin, political philosophy, or socioeconomic standing[84].

As patients take more control over their health decisions in recent years, health institutions are linking digital transformation to their overall outcome. As information is a key resource in the successful treatment of patients, the current and future healthcare systems will face a

number of challenges ranging from health system digitalization, digital transformation, the issue of digital application, slow pace of standards adoption (both by developed and developing countries), and its overall effects on healthcare delivery services. Patients, doctors, other healthcare service providers, hospitals, long-term care facilities, payers including the Medicaid and Medicare programs, and insurance companies are the main players in the healthcare system. The capacity to access and retrieve patient information is heavily influenced by the decision that needs to be made at that specific time[85]. Patients now have increased expectations and a demand for access to high-quality care due to the use of the internet to obtain healthcare information. Adoption of IT resources unquestionably played a big role in improving care quality. The degree of patient awareness has greatly improved because to hospitals' greater use of IT resources[86]. This is because patients have a chance to understand the visual perspective of their health status thanks to the usage of computers, monitors, and digital IT solutions. Additionally, the use of an IT-integrated system is crucial for patient diagnosis and the elimination of medical errors has significantly raised the standard and quality of healthcare results as well as patient safety[87]. In the United States, clinical errors are responsible for at least 44,000 fatalities per year. Most of these fatalities are the consequence of procedural mistakes or the failure to give individuals with specific medical problems the appropriate remedies. These errors place a significant strain on the health care system as well as society at large, with direct medical expenses estimated to be $17 billion yearly. Affordability, modern medical technology, and effective treatment are other components of quality in the health sectors[88]. The[17] asserts that improving health systems are essential to promoting increased national and citizen welfare. According to a study done in Bangladesh by[89], a female doctor who is 25 years old stated that utilizing an ICT tool "makes her work easier" and that it increases her efficiency. These increased efficiencies are likely to lead to better employee retention and morale. In a similar vein, data

suggests that IT, as well as e-health products, benefit consumers[90] At contrast to non-users of ICT in the same health facility, IT users are therefore more likely to get informed, receive better support, and have better behavioral results. Imaging technologies have improved and helped make a wide range of medical imaging, remote diagnosis, and even therapy more accessible and less expensive. These trends have potential uses in IT's medical equipment and healthcare

2.9 Integration of IT in HIM Practice in Africa

Including the patient's medical history and complaints, the doctor's physical findings, the outcomes of diagnostic tests and procedures, drugs and therapeutic procedures, and more, a medical record is a chronologically recorded account of a patient's examination and treatment. In actuality, a patient's medical record is a clinical depiction of the patient that has been developed through time by numerous doctors with the cooperation, confidence, and trust of the patient. It allows for continuity of care and, over time, develops into a vast clinical database from which varied and important clinical data is acquired for research. Additionally, although medical records have various uses, their main goal is to support patient care, and in practically all Ghanaian public health facilities, they are kept in folders. By enhancing both the performance of the doctors and the patient outcomes, record structuring can directly help the patients. The records serve as a form of identification for patients. The proper organization of medical records for patients makes them easy to find, reduces hospital patient wait times, and guarantees care continuity. Therefore, it is essential that medical records be maintained at all times in the patient's and clinician's best interests[91]. While the patient has the right to information, the medical file must always be in the care of the healthcare facility. With only nearly half (52.2%) of the information being accessible within an hour, some of the records in other developing nations' record-keeping systems are insufficient, and patients

frequently use numerous patient health records. It was discovered that some hospitals in Ghana don't have recordkeeping systems in place that are intended to collect data on specific diseases. This has an impact on these diseases' monitoring, supervision, and decision-making.

The use of new technology in healthcare is far from solely being determined by scientific evidence[38]. Based on four case studies that institutional and political considerations involving interests, values, and the distribution of power within the organization frequently influence an organization's decision to adopt new technology.

2.9.1 History of HIM Practice in Nigeria

The first historic meeting was held on 8th June, 1966 which took place at the Lagos University Teaching Hospital. Prior to that, a few Medical Records Officers in the nation had made a significant struggle. In attend ance at the historic meeting were Messrs. Onasanya, Jagun, Omigie, Okpala, Miss Shadare now Mrs. Adenubi and Miss Shadare. Mr. Akpabio joined on July 6, 1966, when the second meeting was held. According to our British perspective, the official name approved for the association was Nigeria Association of Medical Records Officers. Sadly, the 1966 Nigerian Crisis prevented any additional formal meeting. On May 3, 1969, a meeting was held when a new effort was made. The 1966 draft constitution, which was never passed, was brought up for consideration during a meeting on July 12, 1969. Mr. Onasanya, Mr. Jagun, Mr. Omigie, Mr. Shoge, and Mrs. Adenubi were in attendance at that meeting. It was resolved to summon another meeting to make a final choice regarding the constitution. Messrs. Onasanya, Jagun, Omigie, Shoge, and Akanji were present at the historic meeting, which took place at University College Hospital in Ibadan on October 11, 1969.

The main goals of that meeting were to approve the constitution, start the processes required to assure effectiveness, and spread the much-needed awareness throughout Nigeria so that medical records staff could be trained. Medical/Health Records/Health Information are as old as medicine, so it stands to reason that they should also be as old as the global development of conventional medicine. Traditional medicine was the predominant form of healthcare in Nigeria prior to the establishment of colonial rule, but sadly, there aren't many written documents (records) concerning it. The development of medical work in Nigeria was greatly aided by the missionary groups. They did establish organized medical care in West Africa first, after all. In Abeokuta, for instance, the Roman Catholic Mission built the Sacred Health Hospital, which was finished in 1875. The fact that some military hospitals were built to serve sailors, naval squadrons, and colonial officers should also be recalled. Also constructed in Asaba in 1888 was a small temporary improvised public hospital. The hospital nursing sister or medical social officer (almoner), as they were known, started and preserved the medical records in each of these hospitals, and they were kept carelessly. Medical pioneers from the Anglican Church, Sudan Interior, and Sudan United Missions began a well-organized medical activity in Nigeria within the past decade or century. Health care services, as well as the construction of both missionary and government hospitals, continued to grow gradually and included some renowned private institutions. The government then established a department of surgery and the position of dean of the medical school was created as a result of the implementation of the health record system at University College then now University College Hospital, Ibadan, an established affiliate of the University of London. Prof. Beatrice Joly was appointed head of the school in March 1948, but she also had to instruct medical students, some of whom came from the Yaba College, at the General Hospital in Lagos.

Source: Health Records officers Registration Board of Nigeria, obtained at http://www.hrorbn.org.ng/our-history[92]

2.9.2 Improving HIM in Nigeria Using Information Technology

A crucial stage in the development of health information systems is the creation of regional information interchange between healthcare institutions, different health systems, and health initiatives. Health information exchange implies that healthcare delivery costs can be decreased by making health-related data available at the time of service or health planning in all departments. It also promises significant financial and social benefits.

The enhancement of health information systems in low-income nations is just one of the numerous initiatives underway that depend on information interchange employing the most recent IT capabilities and advancements. These efforts to exchange health information operate at a higher level of maturity. The most frequent one has to do with how different health programs' actions for planning health are coordinated. In order to provide safe, all-encompassing access to comprehensive healthcare information and to enhance healthcare via quality, several developing countries are currently working to construct local, regional, or national health information infrastructures or plans. health data reporting from healthcare facilities is complete and timely[93].

Through prompt disease reporting, this will enhance the capacity to monitor higher-quality information and enhance case management and care coordination. These techniques have enhanced the ability to plan and distribute resources for healthcare services as well as analyze care patterns. The option to switch from a conventional paper-based retrospective data collecting and review mode of operation to a real-time, interactive electronic data interchange and action response practice is provided by the regional health information infrastructure. Additionally, it aids in decreasing healthcare expenses, preventing medical errors, increasing access to affordable healthcare, and enhancing administrative effectiveness. The most

difficult difficulty is determining how well initiatives to use computer technology to improve the flow of health information are working.

2.9.3 Application of IT in Health Information Management Practice

Application of Information Technology (IT) in Nigeria Healthcare delivery system have been made better because of information and communication technology (ICT), which has increased service effectiveness and information sharing[94].

In order to have a bureau for carrying out national information technology policy, the National Information Technology Development Agency (NITDA) was founded in 2001. This organization sought to increase internet usage throughout Nigeria. In Nigeria, the GSM was first used in January 2001 and is now widely used. International private organizations (MTN and ECONET) were initially involved in the creation, but the local telecommunication Global Com mobile system was created with the goal of completely releasing Nigeria from the information black hole. In order to efficiently promote the exchange of information necessary for the country's development, Nigeria joined the leaders in ICT by making GSM phones available in some areas. The positive effects of ICT are being reaped by producers, academic institutions, healthcare providers, financial institutions, media networks, and small businesses alike. The advantages of utilizing IT within an organizational setting are widely known[25]. It enables businesses to manage internal knowledge, enhance decision-making, and boost the effectiveness and efficiency of many critical business operations[48]. Despite these organizational advantages, it has been questioned whether IT can produce a competitive advantage as IT capabilities transform from uncommon and distinctive resources to commonplace commodities[95]. Similar to the productivity improvement linked to greater IT

use, there is still a great deal of uncertainty. The productivity paradox states that increases in productivity have not always been associated with higher IT usage.

Better working practices and technological advancements were included in[15] definition of innovation. He thought that innovations may take the form of new processes, products, marketing strategies, or distribution channels. He said that "in actuality, much innovation is very humdrum and incremental rather than radical." A network view can be used to observe technological innovation and progress. The processes of invention and innovation, according to[95], "occur across firms and not only within them." This viewpoint highlights how vital networks within and outside of healthcare institutions are to the innovation process. Healthcare services have been significantly impacted by technological innovation, particularly the development of clinical information systems and the significance of the internet. You may say that the fact that "consumers of health care services are ahead of the profession in their acceptance of electronic means of receiving information" indicates that we are living in a time of significant change[15]. Processes in healthcare services are anticipated to be duplicated quickly and effectively, occasionally without any human involvement. According to[15] defined technology in healthcare is "broadly defined to include the drugs, devices, medical and surgical procedures used in health care, as well as measures for prevention and rehabilitation of disease, and the organizational and support systems in which health care is provided."

In conclusion, technology will propel transformation in the healthcare industry. People are anticipated to want more accomplishments and a higher standard of living. The interface between healthcare practitioners and patients, for example, or advancements in the life sciences like biogenetics and genomics, would likely benefit from technology innovation[97.] Thus, telemedicine systems which may be described as the delivery of medical services

through information technology (IT) systems have become a new means to provide healthcare for patients where the only difference is distance[94]. For the patient, using telemedicine and other programs or systems offers several benefits. It saves time and money and encourages adherence to follow-up appointments. It enables doctors to share experiences, further their knowledge, and train themselves as healthcare providers. It offers the healthcare company the advantages of telemedicine services, including cost effectiveness and higher patient care standards. A telemedicine system must be implemented into a healthcare system, which is not an easy process and one that many organizations have found to be challenging and inventive[98]. This is because it necessitates changes to how patients are treated medically. All of the stakeholders that are involved in the implementation of telemedicine must provide input as part of this change.

Information and communication technologies, or ICTs as they are frequently referred as, have proliferated tremendously during the past two decades. Nearly all parts of the world are connected by communication networks, which range from simple telephone lines to mobile phone networks and satellite communication. The Internet has developed into a major information source, and practically any kind of content from daily newspapers to stock market share values to specialized scientific journals can now be accessed there. Finally, everyone who can afford a computer may now produce digital material because today's desktop computers are easily equipped to handle complicated multimedia content, including movies and photos. Almost every area of our life now involves ICTs which are used in a wide variety of ways in the healthcare industry. The handling of administrative data, such as billing and general record-keeping are perhaps the most prevalent that we cannot even recall a time before ICTs. Additionally, hospitals are aiming to digitally store all patient-associated data utilizing electronic medical records (EMR) or electronic health records (EHR) as the management of patient information electronically assumes increasing importance. Today

many novel techniques in medical practice also have a direct connection to ICTs like the Digital radiology (DR), film-less solutions, which store all image data primarily in electronic form and only transfer it to film for reading in locations not (yet) equipped with digital X-ray viewing stations, are increasingly replacing conventional medical imaging procedures like CT (Computerized Tomography) or MRI (Magnetic Resonance Imaging), as well as in standard radiology (such as plain thorax x-ray). ICTs have also become indispensable in the field of current evidence-based medicine, where it is now nearly difficult to access the evidence base without their assistance. The National Library of Medicine's online database, PubMed, allows users to search for scientific papers. Following that, articles are accessed via "virtual libraries" in the form of PDF (Portable Document Format) files. Online medical evidence databases like Cochrane are often accessed. Additionally, there is an incredible quantity of information available via the World Wide Web, from electronic teaching aids to online patient forums for virtually any ailment.

The four primary areas of IT utilization in healthcare are "Health & Education, Hospital Management Systems, Health Research, and Health Data Management." People can find, access, learn, and communicate with others quickly in our digital age. This makes education available, accessible, and open to everyone. The goal of health education is to increase public understanding of communicable diseases, health status, preventative measures, and various modern diagnostic and therapeutic techniques. People now have the freedom to select the top medical facilities and practitioners to get treatment from in order to live a healthy life. IT enables hospital administration to successfully steer the enterprise. This aids management in overcoming the obstacles the hospital faces. IT aids management in keeping up with the most recent technological developments, learning about population health and statistics, and keeping track of government regulations. It also helps management to increase patient safety and satisfaction.

Finding potential preventive methods to halt the spread of diseases and eradicate them is made easier by IT in healthcare research. There is new technology available for diagnostics that cuts down on both time and expense. By offering therapy in advance, this saves the lives of numerous people. IT can be used to replace outdated healthcare systems and create new, high-quality care delivery models. The electronic storage of medical data is the primary function of IT in hospitals. This facilitates quick information retrieval. The patient or the doctor might receive the data through IT for consultation. The patient can access their own medical records whenever and wherever they are needed. There are several approaches to improve the healthcare system using information and communication technology. In order to implement more improvements and raise healthcare to a much higher level, which is crucial for the development of the nation, the healthcare industry must use IT more wisely. Even though both developed and developing nations have a keen interest in implementing EHR, benefits of the EHR include accurate data management and storage, the ability to record a patient's state at any time, and a reduction in the chance of data replication[53]. Only 151 (or 0.89%) of the 17,068 healthcare facilities are owned by the federal government, 1,385 (8.1%) by the state government, 7580 (44.4%) by local government regions, and 579 (3.4%) by communities and religious groups. The remaining 7,373 (43.2%) facilities are privately owned (National Bureau of Statistics, 2007). In contrast to the $34 that is generally advised, public spending on health is less than $10 per capita. Despite the fact that poverty in Nigeria is an endemic problem, private spending on health care is projected to account for over 70% of all spending, with much of it coming from out-of-pocket expenses (Federal Ministry of Health, 2004).

The[17] has identified a number of issues that the Nigerian health system must address, one of which is an insufficient health information system for monitoring and analyzing health indicators. Due to the potential advantages of an integrated electronic health record system,

several industrialized nations have already implemented one or are in the process of doing so. The practicality of EHR in places with limited resources is being shown via a pilot study in a number of poor nations, including Kenya, Malawi, Peru, and Haiti. However, the adoption rate of EHRs is typically seen as being extremely low, in part due to the lack of valid data on its advantages, the scarcity of examples of successful large-scale deployment, and the related expense. Perhaps Nigeria should start considering a nationwide electronic health record to help integrate the health data for research, budgeting, and resource allocation as well as monitoring and evaluating intervention options now that the viability of such projects in developing economies has been demonstrated[99], the rapid growing coverage of mobile telecom services, and the emerging low cost of information and communication technologies. It is now necessary to provide local content for health care services by making health a requirement for the provision of high-quality services.

2.9.4 Benefits of IT on Health Information Management Practice (HIM)

Both developed and developing countries have benefited from information technology's good influence on health information management practices, which has enhanced the healthcare industry. Stakeholders in the hospital, including management, medical staff, and patients, are impacted favorably. Information technology processes data more cheaply than a manual system, which lowers the operating costs of a hospital[100]. Information technology opens up the possibility of easily sharing patient files without endangering patient privacy. It is utilized for hospital management tasks like appointment and admission scheduling. By minimizing paperwork and waiting times, information technology increases the effectiveness of medical staff. It provides information in an easily legible manner for use by hospital staff. As soon as the results of the patient's tests are ready, they can be added to the patient's case file. Patients can access health information at any time, and their data can be kept private with the use of

encryption and password security. It also helps patients find the location of the medical facility and its staff. By enabling patients, patients' relatives, and the general public to engage more actively in the process of health promotion and education through social networking, Web 2.0 technology has opened up the possibility of expanding the service of HIS (Facebook, Twitter, etc). Additionally, a database management system allows health organizations to quickly retrieve historical records, enabling the sending of those documents to another health organization in an emergency. Computer technology can also have a negative impact on health information management which will lead to poor health care, only if the systems are not properly designed and used and the data in the systems are inaccurate.

Regardless matter how IT is used, there are some obstacles. The following were noted as typical impediments to using IT. These consist of:

Security Safety and cybersecurity are two of the biggest issues that IT must deal with nowadays. Given the enormous value of these assets and the potential harm from getting this wrong, keeping the data, identities, and personal information we share and interact with on a regular basis secure has become difficult.

1. The internet has become the main source of medical information: Online medical research is becoming more and more popular: Searching for remedies and medications online is also a part of this, in addition to checking up symptoms. However, patients now have greater authority to decide what to do next thanks to the Internet, even though it is never a good idea to fully forego visits to the doctor[98].
2. Social media is being used by medical establishments to contact patients: It is simple to understand how public health clinics, medical offices, and even research institutes might benefit from social media platforms to reach larger communities. They are clearly going above and beyond, as shown by the facts. Hospitals and other healthcare

facilities are interacting with patients on social media, responding to inquiries about procedures, launching public awareness campaigns, and engaging with the local community.

3. Better treatment and less suffering: The most visible way that technology has altered healthcare is through the development of new devices, medications, and therapies that increase the likelihood that patients will recover from illnesses and save lives. Advanced medical procedures not only directly aid patients in recovering, but modern technology has also boosted research, allowing specialists to further increase the effectiveness of healthcare[87].
4. Patient care and employee productivity have improved: Patient treatment is now safer and more reliable than it ever was because of computer technology. For the purpose of documenting a patient's medical history and ensuring that the right therapy is being given, nurses and doctors use handheld computers. Lab test results, vital sign logs, and medication orders are all electronically entered into the main database, which may then be accessed later.
5. It's simpler to contact doctors and to do their duties better: Medical professionals now have access to thousands of pages of textbooks at the touch of a Smartphone. They can simply look for case studies and review comprehensive patient histories by using online medical databases. In addition, technology has made it possible for doctors to consult with colleagues around the globe via e-mail, texts, videos, and conference facilities.
6. Medical trends can be predicted with accuracy via online databases: Search engines like Google have been able to accurately forecast medical trends like flu outbreaks by analyzing the health information that users search for online. This innovation aids healthcare professionals in both speedy outbreak response and proactive prevention

action. Additionally, these internet behemoths will have more data to use in scientific studies as more people turn to the internet to research their medical issues[101].

1. Accessibility

Particularly for senior roles within an organization, data accessibility and availability are critical. With interoperability, making data accessible for all parties would be relatively simple. Although the advantages it may provide are generally known, IT still faces a number of challenges before it can fully empower consumers.

2. **Powerful Networks**

Internal networks need to be secure, robust, resilient, and scalable, which is both important and extremely difficult. To reduce obsolescence in the business, solutions must not only address current needs but also be future-oriented and take into consideration anticipated technology improvements.

3. **Integration of Systems**

In many organizations, an implementation IT problem is ensuring that the various services, written in different technologies or languages, interact correctly. Although there are many more benefits to system and service integration.

4. Cost Cutting

IT executives are under constant pressure to save expenses while still delivering innovation and efficiency increases. Competitive firms can concentrate their investment on innovation when they can give the same capability for less money. Organizations must make sure they are ahead of the curve on this issue as IT continues to progress and evolve at a rapid rate, creating new opportunities to deliver more for less.

5. Cloud Computing

It is often referred to as software as a service or on-demand computing. In place of internal IT applications and services using local servers or personal devices, cloud computing is the shared use of distributed computing resources. The Internet of Things (IOT) and artificial intelligence (AI) are only two examples of the technologies that the cloud is the ultimate enabler, bringing up new avenues of revenue (IOT). But in order to take use of this technology, professionals are required, and there aren't enough of them around right now. The cloud is being used by every company in the IT sector to accomplish a wide range of operations, including data backup, disaster recovery, email, virtual desktops, software development, and testing. One can use services from the cloud provider to access resources like processing power, storage, and databases rather than purchasing or owning actual data centers and servers. Cloud computing is ranked as the second most difficult hiring market in the world by IT decision-makers. Nevertheless, there are a number of problems and worries related to cloud-like costs, service provider dependability, downtime, data overload, password, security issues, and last but not least, data privacy, third-party data centers, as well as worries about making the wrong choice before the industry reaches a mature stage[102]. However, cloud computing seems to offer major economic rewards if the risks can be managed in a company setting where change is necessary to survive. The ability of IT departments to quickly adopt cloud computing to the advantage of their organizations as a whole will therefore be one of their biggest problems[109].

6. **Support from the Leadership in Putting New Skill Development First**

Despite the fact that some IT decision-makers have budgeted for training, they nevertheless refuse to approve it. Despite having access to formal training, 41% opted not to take it. Nearly 20% of IT experts claim that management does not perceive any concrete advantages from training. That's a tremendous disconnect, especially considering how eager IT professionals are to learn new skills and advance their careers. Without the backing of the leadership, it is challenging to do that. Uncertain work tasks and responsibilities and low staff morale are frequently attributed, properly or unjustly, to IT management. The most common complaint is lack of communication. IT experts think that leadership isn't always open, particularly when it comes to.

7. Data Analysis and Management

This is the area where IT departments have the greatest skill deficit, excluding cybersecurity and cloud computing. An abundance of new data is proving difficult for organizations to manage. IDC predicts that by 2025, the globe will produce and duplicate 163 zettabytes (ZB) of data, ten times as much as was produced in[103]. The continual accumulation of new data poses several storage and security problems that need to be handled. To manage this data explosion, IT specialists are badly needed, but it is difficult to find those who are competent, which has made the issue worse. The good news is that the majority of cloud systems, including AWS and GCP, enable data collection, processing, storing, and analysis all in one location.

8. Automation

Cloud migration might benefit from automation as well. Many migration procedures for businesses going to the cloud, like manual configuration, can be automated, cutting down the

time it takes from days to minutes. The significance of automation in cybersecurity is undoubtedly expanding. It should be used to anticipate cyberthreats and deploy countermeasures more quickly than is possible manually. According to[81] Issues in the Use of Information Technology (IT), there are three general approaches to using computers and the Internet for instruction: learning about computers and the Internet, where the end goal is technological literacy; learning with computers and the Internet, where the technology facilitates learning across the curriculum; and learning through computers and the Internet, where technological skills are integrated.

2.9.5 Challenges Associated with Use of IT on HIM Practice

Computer laboratory equipment has suffered significant damage as a result of Nigeria's poor electric power supply, which can harm computer parts like motherboards and hard disks. Additionally, this may cause software to malfunction. Due to power outages and equipment damage, the majority of internet facilities in Nigeria experience regular outages. This frequently disrupts hospital services for both patients and staff. The Nigerian government needs to take a close look at this power issue and act quickly to solve it. The majority of businesses should have generators or generate sets to keep running in the event of a blackout.

The Nigerian government has not yet shown appreciation for the use of computer technology in the provision of healthcare. The government does not view computer technology as a tool that can promote health and offer citizens access to high-quality healthcare facilities. At the moment, neither medical facilities nor teaching hospitals have websites or EHR. The establishment of an organization with a distinct mandate and budget from the health ministry that will oversee the deployment of ICT in Nigerian hospitals will help the Nigerian government encourage the use of ICT in health care delivery systems. By enabling the storage

and online access of staff and patient records in a database, this should attempt to simplify the delivery of healthcare.

2. **Cost of IT Infrastructure**

Because we mainly rely on pricey imported technology, the price of computer hardware and software in Nigeria is very high compared to the income of an average Nigerian, making it unaffordable for the majority of individuals. The creation of indigenous technologies is necessary.

3. **Telecommunications Infrastructure**

Nigeria's telecommunications infrastructure is insufficient. Information collection from the computer is complicated by unreliable telecommunications infrastructure. The Nigerian government has to find a way to bring back a landline phone system, which is more cost-effective to operate and is functional and efficient. A hospital intranet is also required because it will improve communication.

4. **Internet Accessibility**

The Internet not only changes the way that information moves throughout the health industry, but it also helps to control expenses. Due to the anticipated 10:1 to 100:1 cost savings in ordinary operations, healthcare firms employ the Internet for business activities. Due to the high equipment expenses, communication satellites are uncommon in Nigeria. The deployment of fiber optics in hospitals is something the government should also think about.

5. **Resistance to New Technology**

The adoption of new technology depends on the user, who may have both positive and negative experiences with it. Like any other citizen of the world, many Nigerians will oppose new technological advancements that will have a negative impact on their employment. Before the introduction of new technology, downsizing is frequently brought up in Nigeria, and this invariably results in resistance from the workforce out of fear of losing their jobs. The government should train hospital staff members on how to use ICT rather than firing them and hiring people with ICT skills in order to use it in Nigerian hospitals.

6. **Computer Literacy**

Thanks to developments in information management, the computer has practically become a necessity for providing quality patient care. Many employees who work in various records units lack computer literacy, which prevents them from operating computers and storing data in software. In order for personnel to be more productive at work, a conscious effort must be made to update their understanding of computers.

7. **Lack of Maintenance Culture**

Another issue is the lack of maintenance culture; even government organizations in Nigeria struggle to maintain ICT equipment. For any ICT device, both preventive and remedial maintenance are crucial. The financial strategies for purchasing any equipment should account for its maintenance and value depreciation, which is not the case in many Nigerian firms. An ICT policy that prohibits any Organization from importing, providing, and installing any ICT equipment for another Organization or for herself without a maintenance agreement could be used to enforce this.

The following issues with the use of IT in HIM practice is mentioned by[104]:

1. **Insufficient Funds**

Due to ongoing hardware and software changes, record digitization demands significant financing, and the rising cost of online database subscriptions makes it simple for information seekers to identify them on a worldwide scale.

2. **Technical Knowledge**

Education of record keepers in the hospital community on the best ways to handle hospital records is one of the main obstacles to the preservation and conservation of hospital records in developing nations. The fact that record preservation is not emphasized in the majority of medical science curricula makes this task much more difficult. For instance, in Nigeria, there are few or no locations where one can receive a formal professional education in archives, record preservation, and conservation. Additionally, many African nations have a general lack of technological sophistication. Resources for people and personnel are never enough. There are a few HIM professionals who work in archives and record units who have a basic understanding of computer science and its applications; as a result, there are frequent ICT facility breakdowns and service interruptions in digitized record units. Most African states also fall behind in terms of technology and telecommunications infrastructure. Many African countries struggle to find human capital with the necessary skills, competencies, and attitudes to launch, carry out, and maintain digitization programs.

3. **Absence of Laws or Policies**

African politicians, according to[44], either ignore or fix digital preservation issues insufficiently because they are not aware of or comfortable with digital preservation standards. Due to copyright regulations, internet connections are another issue with digitalization. Most national laws do not adequately specify the software copyrights

necessary to access digital information or the right to copy for preservation, thus these resources should not be digitized if permission cannot be obtained.

4. Digital Media Degradation

It is crucial for information professionals to stay current with any of these innovations and determine how technology and technologies can be integrated and utilized in their operations due to how quickly technology is developing and the constant introduction of new technologies. The long-term loss or inaccessibility of digital content is caused by the deterioration of digital media. This is due to the fact that after digitization, the media starts to degrade or decay. Another issue is that digital media might be destroyed by disasters or viruses, therefore Africa may not have adequate organizational systems for managing e-records. The harsh environmental conditions in Sub-Saharan Africa are also aggravating the decline in demand for the re-digitalization of electronic equipment.

5. Computer Phobia

Due to the lack of information technology capabilities in Africa, many traditional librarians, record keepers, and archivists are liberal and fear computers. Because the new and old professionals are from different generations, computers are seen as a danger to their status as experts. As a result, they struggle to keep up with or compare to the demands of the electronic/digital era while also being "too unwilling to quit the old hobbies for new ones". Digital technology implementation in poor countries must have the chance to overcome employee and individual resistance to the innovation.

Technology infrastructures that aren't adequate Power outages are a serious barrier to digitization in Africa. Where there is a standby power generator, this has the effect of destroying digital or IT equipment, and the costs of operating them are expensive.

Additionally, the severe environment of Sub-Saharan Africa may not be conducive to technical equipment. The majority of African nations lack adequate and reliable electrical supply, making it challenging to create a favorable and long-lasting technological environment suitable for digitization projects across the continent. Once more, the majority of African nations lack appropriate or only partially developed telecommunications infrastructures, and only a handful of them have the advanced digital and packet switching capabilities necessary for data transfer. According to[26], the majority of Nigerian hospitals rely largely on paper-based medical records, which present a number of difficulties like the possibility of termite assault, fire outbreak, and flood[27] continued by arguing that the implementation of IT-based programs must begin in order to replace the current paper-based information management systems in the majority of developing countries' public health institutions. These institutions have historically been in a difficult phase of transition, frequently encountering a variety of context-sensitive barriers and issues like a lack of sufficient resources (terrible monetary resources) and uneven infrastructural growth[57]. Political and bureaucratic restrictions, broken and uncoordinated organizational structures, a diversity of stakeholders, and a lack of knowledge and skills needed to deal with evolving systems and technology.

6. Technical Obsolescence

As computer hardware and software continue to advance, digitalization and record preservation in Africa are challenged by this phenomenon. It results in the loss of the ability to access digital information. Continuous updates to the operating system, the use of programming languages, and the storage medium all contribute to technological obsolescence. In order to avoid being technologically out of date digital records be transposed every ten to twenty years.

7. Hardware and Software Modifications

Regular technological and hardware advancements put tremendous strain on records management when the preservation of digital archive collections is focused on the intermediate process for preserving digital data, switching to the new medium, and giving long-term access. Not merely the deterioration of storage medium, but also the problem of quickly changing storage technologies, is one of the biggest issues preventing the sustainability of digital collections in developing nations. The informational content of the digitized data is preserved, in contrast to analog information, which places emphasis on the preservation of tangible objects. Because "the continual transition in software and technology poses a burden for employees working on digital durability," archivists in Africa and other poor nations must work diligently to ensure that digital data is preserved.

2.3 Review of Empirical Studies

2.3.1 Attitude Towards IT Application in Health Care Delivery

The study reported (86%) positive attitudes on the use of digital health Technology among healthcare workers providing maternal healthcare services in Tanzania[133]. Another similar study conducted in Ethiopia reported that the overall, healthcare providers' attitude towards IT was found to be good[134].It was documented that 74% had positive Attitudes among healthcare professionals towards ICT and home follow-up in chronic heart failure care in Sweden[135]. It also observed from a study that generally, healthcare workers in Kuwaiti had positive attitudes toward computerized health information systems[136]. Another similar study has reported that 95% of Pharmacists had positive attitude on the Use of Telepharmacy in Response to COVID-19 Pandemic in Ho Chi Minh City, Vietnam[137].

Similarly, it's also documented from a study conducted in Philippine that healthcare workers express positive attitude toward used of computer at work[138].

2.3.2 Benefits of IT Application on HIM Practice

Health information technology (IT) has the potential to improve the health of individuals and the performance of providers, yielding improved quality, cost savings, and greater engagement by patients in their own health care. [100] Despite evidence of these benefits, [2] physicians' and hospitals' use of health IT and electronic health records is still low. [3,4]To accelerate the use of health IT, in 2009 Congress passed and President Barack Obama signed into law the Health Information Technology for Economic and Clinical Health (HITECH) Act, as part of the American Recovery and Reinvestment Act. HITECH makes an estimated $14–27 billion in incentive payments available to hospitals and health professionals to adopt certified electronic health records and use them effectively in the course of care. [1] The legislation also established programs within the Office of the National Coordinator for Health Information Technology to guide physicians, hospitals, and other key entities as they adopt electronic health records and achieve so-called meaningful use, as spelled out in federal regulations. [101] The legislation and subsequent regulations were designed to spur adoption and yield benefits from health information technology on a much broader scale than has been achieved to date. Building on that effort, the Affordable Care Act of 2010 underscored the importance of health IT in achieving goals related to health care quality and efficiency.

Study was conducted on the Benefits of Health Information Technology: A Review of the Recent Literature Shows Predominantly Positive Results and the result shows that 154 included studies, 96 (62 percent) were positive, which means that health information technology was associated with improvement in one or more aspects of care, with no aspects worse off; and 142 (92 percent) were either positive or mixed-positive[98]. Another study conducted in US on the concluded Benefits of Information Technology–Enabled Diabetes Management that ITDM improves processes of care, prevents development of diabetes complications, and generates cost-of-care savings [102]. Also, another similar study concluded that HIT has the potential to enable a dramatic transformation in the delivery of health care, making it safer, more effective, and more efficient[98]. It was also documented on a study that despite growing interest to adopt HIT to improve safety and quality, adoption remains limited, especially in the area of ambulatory electronic health records and physician-patient communication[99]. However, another study concluded that HIT has the potential to positively impact on physician practice organizations, although significant and diverse barriers block adoption. Research into these obstacles should be coupled with efforts to understand barriers to effective implementation after HIT adoption[100]. The findings of this study are similar to a study that reported that HIT is increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system[95]. Another similar study conducted, reported that E-health and information and communication technologies benefit the whole society by improving access to medical services and improving their quality[103]. It was also documented that information and communication technologies (ICTs) have the potential to transform radically the delivery of healthcare and to address future health challenges[104]. It was also conducted among healthcare professionals that the advantageously use of ICT applications in home care as a tool to support people living with chronic illnesses gaining control of their illness that promotes self-care[90].

2.3.4 Application of IT Innovations and Products

Even though both developed and developing nations have a keen interest in implementing EHR, benefits of the EHR include accurate data management and storage, the ability to record a patient's state at any time, and a reduction in the chance of data replication[94]. Only 151 (or 0.89%) of the 17,068 healthcare facilities are owned by the federal government, 1,385 (8.1%) by the state government, 7580 (44.4%) by local government regions, and 579 (3.4%) by communities and religious groups. The remaining 7,373 (43.2%) facilities are privately owned[97]. In contrast to the $34 that is generally advised, public spending on health is less than $10 per capita. Despite the fact that poverty in Nigeria is an endemic problem, private spending on health care is projected to account for over 70% of all spending, with much of it coming from out-of-pocket expenses[99]

Another study was conducted in Singapore, reported that Information Technology (IT) has transformed the ways modern healthcare systems used to acquire, store, access and communicate medical information[102]. Similarly, a study was conducted among care givers in Iran, it reported that the use of modern information and communication technology in hospitals facilitates access and transfer of information, and also accelerates patient's admission and discharge process, relation between hospital units, providing medical equipment supporting affairs' process and diagnostic procedures[142]. Another study reported that there is substantial evidence that Health Information Technology plays a key role in improving patient outcomes, patient safety, and saving time for the clinicians have emerged as one of the most beneficial health information systems. A study conducted among healthcare providers in the US reported that health Information Technology (IT) is regarded as an essential tool to improve patient safety and a range of initiatives to address patient safety are under way[95].

2.3.5 The Associated Challenges of IT Application

A study conducted in Nigeria reported that technology and human resource are the challenges or barriers affecting use of IT[97]. It was also reported from another study that the use of digital self-care applications in relation to major surgery was also considered to create challenges by affecting the interactions between healthcare workers and patients in different ways[99]. Another study conducted in Benghaz, concluded that today the ever-pervasive Internet and telecommunication and information technologies in the wider society have led to many changes in health care and nursing[100]. It was reported that despite HIT apparent promise, health information technologies (HIT) have proved difficult to implement. This systematic review reveals the implementation barriers associated to organizational management and their interrelations. It was similarly documented that incomplete hardware and software features, time-consuming ICT adoption, heavy or increased workloads, perceived lack of usefulness of ICT, cost or budget restrictions, security and privacy concerns, and lack of integration with technologies are the barriers to the use of IT in healthcare practice[101].The reviewed articles looked into technological barriers to ICT adoption, such as ICT skill, ICT knowledge, a lack of training opportunities, a lack of computer literacy, a lack of computer access, inadequate internet connectivity, and a lack of experience with ICT were cited as barriers to ICT implementation in healthcare system. Furthermore, organizational components such as Lack of job satisfaction, Lack of Refreshment training, poor staff initiation, management problem, poor infrastructure, and lack of resources remained barriers to ICT adoption in Ethiopia's healthcare system[103].

End Notes

1. S. Lee, and Yu, Soyoung. 2021. "Effectiveness of Information and Communication Technology (ICT) Interventions in Elderly's Sleep Disturbances: A Systematic Review and Meta-Analysis." **Sensors** 21, no. 18 (January): 6003. https://doi.org/10.3390/s21186003.

2. S.M. Omole. 2019. "influence of health records management practice on disease surveillance and notification system in atakunmosa west local government area, osun state, nigeria." **International Journal of Advanced Research** 7, no. 1 (January): 579–89. https://doi.org/10.21474/ijar01/8365.

3. "Trends in Information Technology Project Management." 2016. **Issues in Information Systems**. https://doi.org/10.48009/3_iis_2016_187-198.

4. F.S.N. Abdel-Hameed. 2020. "Information Technology and Assessment." **Encyclopedia of Education and Information Technologies**, 932–37. https://doi.org/10.1007/978-3-030-10576-1_47.

5. K. M. D. Cresswell, Bates, and A. Sheikh. 2013. "Ten Key Considerations for the Successful Implementation and Adoption of Large-Scale Health Information Technology." **Journal of the American Medical Informatics Association** 20, no. e1 (June): e9–13. https://doi.org/10.1136/amiajnl-2013-001684.

6. S.M. Omole. 2019. "influence of health records management practice on disease surveillance and notification system in atakunmosa west local government area, osun state, nigeria." **International Journal of Advanced Research** 7, no. 1 (January): 579–89. https://doi.org/10.21474/ijar01/8365.

7. I. T. Adeleke. *et al*, 2020. "Opinions on Cyber Security, Electronic Health Records, and Medical Confidentiality: Emerging Issues on Internet of Medical Things from Nigeria." Incorporating the Internet of Things in Healthcare Applications and Wearable Devices. 2020. https://www.igi-global.com/chapter/opinions-on-cyber-security-electronic-health-records-and-medical-confidentiality/238979.

8. J. Haaga, *et al.* 2010. "Reproductive Aging: Theoretical Perspectives, Mechanisms, Nonhuman Models, and Health Correlates." **Annals of the New York Academy of Sciences** 1204, no. 1 (August): 1–10. https://doi.org/10.1111/j.1749-6632.2010.05700.x.

9. R. E. Yaya-Beas e al. 2015. "Yaya-Beas, R.-E., *et al.* Helminth Egg Removal Capacity of UASB Reactors under Subtropical Conditions. Water 2015, 7, 2402–2421." **Water** 7, no. 9 (September): 5152–54. https://doi.org/10.3390/w7095152.

10. J. Martin. 2009. "Global Institutions: The World Health Organization (WHO)." **Bulletin of the World Health Organization** 87, no. 6 (June): 484–84. https://doi.org/10.2471/blt.08.060814.

[11.] "10 Principles of Good Medical Record Keeping | Shredall SDS Group." n.d. Www.shredall.co.uk. https://www.shredall.co.uk/blog/10-principles-of-good-medical-record-keeping.

[12.] D. Ogaji, and E. A. Chinelo.. "Implementing Electronic Health Care Record in a Public Health Facility in Nigeria: Awareness, Acceptance and Concerns among Critical Stakeholders." **International Journal of Electronic Healthcare** 2021 11, no. 1: 1. https://doi.org/10.1504/ijeh.2021.10039629.

[13.] N. Radziwill. "Data Quality: Dimensions, Measurement, Strategy, Management and Governance (Book Review)." **Quality Management Journal** 26, no. 4 (September) 2019: 207–7. https://doi.org/10.1080/10686967.2019.1648077.

[14.] K. Bell. "Public Policy and Health Informatics." **Seminars in Oncology Nursing** 34, no. 2 (May) 2018: 184–87. https://doi.org/10.1016/j.soncn.2018.03.010.

[15.] R.S. Janett, and P.Y, Peter. "Electronic Medical Records in the American Health System: Challenges and Lessons Learned." **Ciência & Saúde Coletiva** 25, no. 4 (April) 2020. 1293–1304. https://doi.org/10.1590/1413-81232020254.28922019.

[16.] I.T. Adeleke. 2015. "Health Information Technology in Nigeria: Stakeholders' Perspectives of Nationwide Implementations and Meaningful Use of the Emerging Technology in the Most Populous Black Nation." **American Journal of Health Research** 3, no. 1: 17. https://doi.org/10.11648/j.ajhr.s.2015030101.13.

[17.] C. Burstein. "Total Quality Management in Federal Agencies." **National Civic Review** 78, no. 2 (March) 1989. 103–13. https://doi.org/10.1002/ncr.4100780205.

[18.] S. Mills. "Electronic Health Records and Use of Clinical Decision Support." **Critical Care Nursing Clinics of North America** 31, no. 2 (June) 2019: 125–31. https://doi.org/10.1016/j.cnc.2019.02.006.

[19.] J. Fontenot. "Utilizing Assessment Tools in Decreasing Fall Risk among Community-Dwelling Adults: A Quality Improvement Project." **Home Health Care Management & Practice**, July 2021. 108482232110347. https://doi.org/10.1177/10848223211034773.

[20.] C. Gronkiewicz.. "Development of Electronic Medical Record (EMR) Templates to Optimize Evidence-Based Management of COPD Outpatients." **Chest** 136, no. 4 (October) 2009; 63S. https://doi.org/10.1378/chest.136.4_meetingabstracts.63s-f.

[21.] A. Tubaishat. "Evaluation of Electronic Health Record Implementation in Hospitals." *CIN:* **Computers, Informatics, Nursing** 35, no. 7 (July) 2017; 364–72. https://doi.org/10.1097/cin.0000000000000328.

[22.] J. Soyemi *et al*. "Towards E-Healthcare Deployment in Nigeria: The Open Issues." **Communications in Computer and Information Science**, 2015; 588–99. https://doi.org/10.1007/978-3-662-46742-8_54.

[23.] D. Gustafson. "Impact of a Patient-Centered, Computer-Based Health Information/Support System." **American Journal of Preventive Medicine** 16, no. 1 (January) 1999; 1–9. https://doi.org/10.1016/s0749-3797(98)00108-1.

[24.] B.J. Chaudhry *et al*. "Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care." **Annals of Internal Medicine** 144, no. 2006. 10: 742–52. https://doi.org/10.7326/0003-4819-144-10-200605160-00125.

[25.] "Electronic Health Records Interoperability." n.d. Www.e-Health.standards.org.au. http://www.e-health.standards.org.au/IT014SubjectAreas/EHRInteroperability.aspx.

[26.] E. Monaghesh, and H, Alireza.. "The Role of Tele health during COVID-19 Outbreak: A Systematic Review Based on Current Evidence." **BMC Public Health** 20, no. 1 (August) 2020: 1–9. https://doi.org/10.1186/s12889-020-09301-4.

[27.] R. Vidal-Alaball, *et al*. "Telemedicine in the Face of the COVID-19 Pandemic." **Atención Primaria** 52, no. 6 (April). 2020 https://doi.org/10.1016/j.aprim.2020.04.003.

[28.] R. Dendere. "Patient Portals Facilitating Engagement with Inpatient Electronic Medical Records: A Systematic Review." **Journal of Medical Internet Research** 21, no. 4 (April) 2019 e12779. https://doi.org/10.2196/12779.

[29.] "Tracking Universal Health Coverage: 2017 Global Monitoring Report." n.d. https://apps.who.int/iris/bitstream/handle/10665/259817/9789241513555-eng.pdf.

[30.] C. Free. *et al*. "The Effectiveness of Mobile-Health Technologies to Improve Health Care Service Delivery Processes: A Systematic Review and Meta-Analysis." Edited by Tony Cornford. *PLoS* **Medicine** 10, no. 1 (January) 2013: e1001363. https://doi.org/10.1371/journal.pmed.1001363.

[31.] Center. 2019. "Mobile Medical Applications." U.S. Food and Drug Administration. 2019. https://www.fda.gov/medical-devices/digital-health/mobile-medical-applications.

[32.] Directorate-General for Health and Food Safety (European Commission), Gesundheit Österreich Forschungs- und Planungs GmbH, Sogeti, Julia Bobek, Anna-Theresa Renner, Anja Laschkolnig, and Claudia Habl. 2016. **Study on Big Data in Public Health, Telemedicine and Healthcare: Executive Summary. Publications Office of the European Union**. LU: Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/5db46b33-c67f-11e6-a6db-01aa75ed71a1/language-en.

[33.] W. Raghupathi, and R, Viju. 2014. "Big Data Analytics in Healthcare: Promise and Potential." **Health Information Science and Systems** 2, no. 1 (February). https://doi.org/10.1186/2047-2501-2-3.

[34] S. Kanwal. *et al.*. "Population Health Management: A Roadmap for Provider-Based Automation in a New Era of Healthcare." 2013. http://c4fd63cb482ce6861463-bc6183f1c18e748a49b87a25911a0555.r93.cf2.rackcdn.com/iHT2_BigData_2013.pdf.

[35] Y. YIN *et al.* "The Internet of Things in Healthcare: An Overview." **Journal of Industrial Information Integration** 1, no. March 2016.: 3–13. https://doi.org/10.1016/j.jii.2016.03.004.

[36] I. Srmunera. "Use of Wearables Devices in the Health Sector." DyCare. May 3, 2018. https://www.dycare.com/divulgation/use-of-wearables-devices-in-the-health-sector/.

[37] C. Nøhr.. "Evaluation of Electronic Health Record Systems." **Yearbook of Medical Informatics** 15, no. 01 (August) 2006; 107–13. https://doi.org/10.1055/s-0038-1638481.

[38] "College Quarterly - Articles - an Exploration of the Use of Information and Communication Technologies in the College Classroom." n.d. Collegequarterly.ca. http://collegequarterly.ca/2003-vol06-num01-fall/lopes.html.

[39] K. K. Hayrinen *et al.*. "Definition, Structure, Content, Use and Impacts of Electronic Health Records: A Review of the Research Literature." **International Journal of Medical Informatics** 77, no. 5 (May) 2008; 291–304. https://doi.org/10.1016/j.ijmedinf.2007.09.001

[40] P.G. Goldschmidt. "HIT and MIS." **Communications of the ACM 48,** no. 10 (October) 2005; 68. https://doi.org/10.1145/1089107.1089141.

[41] Safety, Institute of Medicine (US) Committee on Data Standards for Patient. **Key Capabilities of an Electronic Health Record System Letter Report. www.ncbi.nlm.nih.gov** National Academies Press (US) 2003. https://www.ncbi.nlm.nih.gov/books/NBK221800/.

[42] F. Ueckert *et al.*. "Empowerment of Patients and Communication with Health Care Professionals through an Electronic Health Record." **International Journal of Medical Informatics** 70, no. 2-3 (July) 2003; 99–108. https://doi.org/10.1016/s1386-5056(03)00052-2.

[43] V. Icheku.. "Challenges of Protecting Personal Data and Privacy during Online Teaching and Learning." **Academia Letters**, August 2021. https://doi.org/10.20935/al3083.

[44] J. T. Mitchell.*et al*. "Adverse Events in Mindfulness-Based Interventions for ADHD." **The ADHD Report** 26, no. 2 (February) 2018; 15–18. https://doi.org/10.1521/adhd.2018.26.2.15.

[45] S. Y. Liang. *et al*. "Impact of Physician Practice Style on Costs, Clinical Quality, Patient Experience, Physician Productivity, and Physician Time." **Journal of Patient-Centered Research and Reviews** 4, no. 3 (August) 2017; 153–54. https://doi.org/10.17294/2330-0698.1480.

[46] N. Menachemi, and C, Taleah.. "Benefits and Drawbacks of Electronic Health Record Systems." **Risk Management and Healthcare Policy** 4, no. 4 (May) 2011; 47–55. https://doi.org/10.2147/rmhp.s12985.

[47] S. R. Weingarten.. "Interventions Used in Disease Management Programmes for Patients with Chronic Illness---Which Ones Work? Meta-Analysis of Published Reports." *BMJ* 325, no. 7370 (October) 2012; 925–25. https://doi.org/10.1136/bmj.325.7370.925.

[48] C. Lok.. "Picture Perfect." **Nature** 412, no. 6845 (July) 2021; 372–74. https://doi.org/10.1038/35086702.

[49] H. S. S. Mekhjian. *et al.*. "Immediate Benefits Realized Following Implementation of Physician Order Entry at an Academic Medical Center." **Journal of the American Medical Informatics Association** 9, no. 5 (September) 2012; 529–39. https://doi.org/10.1197/jamia.m1038.

[50] J. Lurio. *et al*. "Using Electronic Health Record Alerts to Provide Public Health Situational Awareness to Clinicians." **Journal of the American Medical Informatics Association** 17, no. 2 (February) 2010; 217–19. https://doi.org/10.1136/jamia.2009.000539.

[51] M. Shaikh. *et al*. "Open-Source Electronic Health Record Systems: A Systematic Review of Most Recent Advances." **Health Informatics Journal** 28, no. 2 (January) 2022; 146045822210998. https://doi.org/10.1177/14604582221099828.

[52] M. B. Tan *et al*. "1083 Using an Electronic Health Record (EHR) to Identify Chronic CPAP Users with Abnormal HL7 CPAP Data." **Sleep** 41, no. suppl_1 (April) 2018; A402–2. https://doi.org/10.1093/sleep/zsy061.1082.

[53] K. Bernstein, *et al*. "Modelling and Implementing Electronic Health Records in Denmark." **International Journal of Medical Informatics** 74, no. 2-4 (March) 2018; 213–20. https://doi.org/10.1016/j.ijmedinf.2004.07.007.

[54] A. Scott-Emuakpor.. "The Evolution of Health Care Systems in Nigeria: Which Way Forward in the Twenty-First Century." **Nigerian Medical Journal** 51, no. 2 (April) 2010; 53. http://www.nigeriamedj.com/text.asp?2010/51/2/53/70997.

[55] "Healthcare Knowledge Collection for Clinical Decision Support Systems." 2020. **Issues in Information Systems**. https://doi.org/10.48009/1_iis_2010_538-546.

[56] Reuters. "MOVES-Silverfleet Capital, State Street Global Advisors, Mashreq," April 3, 2017, sec. Financials. https://www.reuters.com/article/financial-moves-idINL3N1HB39U.

[57] "Nigerian Documents: National Health ICT Strategic Framework 2016 | Nigeria." n.d. Nigerian Documents. https://nigeriandocuments.blogspot.com/p/main-document-national-health-ict.html.

[58] N. Kamau, and O. Symphrose.. "The Impact of E-Resources on the Provision of Health and Medical Information Services in Kenya." **Journal of Electronic Resources in Medical Libraries** 5, no. 2 (June) 2018; 133–47. https://doi.org/10.1080/15424060802064329.

[59] Hira Saeed *et. al*.. "Information and Communication Technology in Higher Education: Online Experience of Faculty." **Information Technology in Industry** 9, no. 2 (April) 2021; 1117–22. https://doi.org/10.17762/itii.v9i2.460.

[60] D. Ahn.. "Investigation of Applicability of Additive Manufacturing Processes to Appropriate Technologies for Developing Countries**." Academic Society for Appropriate Technology** 7, no. 2 (November) 2021; 188–95. https://doi.org/10.37675/jat.2021.7.2.188.

[61] M, Stansfield.. **International Journal of Information Management** 25, no. 3 (June) 2018; 282–83. https://doi.org/10.1016/j.ijinfomgt.2005.02.004.

[62] C. AbouZahr, and B. Ties.. "Health Information Systems: The Foundations of Public Health." **Bulletin of the World Health Organization** 83, no. 8 (August) 2005; 578–83. https://apps.who.int/iris/handle/10665/269465.

[63] C. P. Haskew *et al*.. "A Standardized Health Information System for Refugee Settings: Rationale, Challenges and the Way Forward." **Bulletin of the World Health Organization** 88, no. 10 (October) 2010; 792–94. https://doi.org/10.2471/blt.09.074096.

[64] I. Asangansi.. "Understanding HMIS Implementation in a Developing Country Ministry of Health Context - an Institutional Logics Perspective." **Online Journal of Public Health Informatics** 4, no. 3 (December) 2012; https://doi.org/10.5210/ojphi.v4i3.4302.

[65] S. Scalvini, *et al*.. "Information and Communication Technology in Chronic Diseases: A Patient's Opportunity." **Journal of Medicine and the Person** 12, no. 3 (July) 2013; 91–95. https://doi.org/10.1007/s12682-013-0154-1.

[66] C. Sternitzke.. "The International Preliminary Examination of Patent Applications Filed under the Patent Cooperation Treaty — a Proxy for Patent Value?" **Scientometrics** 78, no. 2 (October) 2008; 189–202. https://doi.org/10.1007/s11192-007-1837-x.

[67] S. Lee, and K. Ji-Soon. "Unintended Consequences and Workarounds of Electronic Medical Record Implementation in Clinical Nursing Practice." *CIN:* **Computers, Informatics, Nursing** Publish Ahead of Print, no. June 2021; https://doi.org/10.1097/cin.0000000000000785.

[68] A Noblin, *et al*. "Can Caregivers Trust Information Technology in the Care of Their Patients? A Systematic Review." **Informatics for Health and Social Care** 46, no. 1 (December) 2020; 29–41. https://doi.org/10.1080/17538157.2020.1834399.

[69] R BeLue, *et al*. "The Community Analytics Academy Pilot: A Community-Academic Partnership for Building Community Health Care Analytic Capacity." **Journal of Primary Care & Community Health** 11, no. January 2020; 215013272093240. https://doi.org/10.1177/2150132720932408.

[70] D.J. Hamann, and C.B. Karabi.. "Outcomes of Health Information Technology Utilization in Nursing Homes: Do Implementation Processes Matter?" *Health Informatics Journal*, January 2020; 146045821989955. https://doi.org/10.1177/1460458219899556.

[71] M. Athar.. "Truth About: Coronavirus (COVID19)." **Open Access Journal of Pulmonary & Respiratory Sciences** 5, no. S1 2020. https://doi.org/10.23880/oajprs-16000s1-002.

[72] K. Ramdas, D. Ara, and J. Sanjay.. "'Test, Re-Test, Re-Test': Using Inaccurate Tests to Greatly Increase the Accuracy of COVID-19 Testing." **Nature Medicine** 26, no. 6 (May) 2020; 810–11. https://doi.org/10.1038/s41591-020-0891-7.

[73] J.M. Manrique, and L. R. Jones.. "Genetic Data Generated from Virus–Host Complexes Obtained by Membrane Co-Immobilization Are Equivalent to Data Obtained from Tangential Filtrate Virus Concentrates and Virus Cultures." **Virus Genes** 48, no. 1 (October) 2013; 160–67. https://doi.org/10.1007/s11262-013-0999-7.

[74] I. Herbet, and D. Jérôme. n.d. "Engaging Armed Groups at the International Committee of the Red Cross: Challenges, Opportunities and COVID-19." **International Review of the Red Cross**, 1–11. Accessed December 2021; 2. https://doi.org/10.1017/S1816383121000588.

[75] C. Lin, "Policy Decisions and Use of Information Technology to Fight Novel Coronavirus Disease, Taiwan." **Emerging Infectious Diseases** 26, no. 7 (July) 2019, 2020; https://doi.org/10.3201/eid2607.200574.

[76] P. Jones *et al.*. "Information Technology Coding Systems in the Emergency Department: It Is Not the Tools, It Is How We Use Them." **Emergency Medicine Australasia** 31, no. 5 (September) 2019; 700–701. https://doi.org/10.1111/1742-6723.13378.

[77] "The Research Foundation of Hospital and Healthcare Administration.". **International Journal of Research Foundation of Hospital and Healthcare Administration** 2, no. 1: 66–67 2014. https://doi.org/10.5005/jrfhha-2-1-66.

[78] A. Housego *et al.*. "Delivery of Public Services by Non-Government Organisations (非营利组织的公共服务提供)1." **Australian Journal of Public Administration** 71, no. 2 (June) 2012; 211–20. https://doi.org/10.1111/j.1467-8500.2012.00765.x.

[79] S.Z. Khan *et al.*. "Hopes and Fears in Implementation of Electronic Health Records in Bangladesh." **The Electronic Journal of Information Systems in Developing Countries** 54, no. 1 (October) 2012; 1–18. https://doi.org/10.1002/j.1681-4835.2012.tb00387.x.

[80] S. M. Burney, *et al.* "Information and Communication Technology in Healthcare Management Systems: Prospects for Developing Countries." **International Journal of Computer Applications** 4, no. 2 (July) 2010: 27–32. https://doi.org/10.5120/801-1138.

[81] K. Ehrenreich, and K, Katrina. "Prenatal Care as a Gateway to Other Health Care: A Qualitative Study." **Women's Health Issues**, October 2022; https://doi.org/10.1016/j.whi.2022.08.006.

[82] J.M. Manrique, and L. R. Jones.. "Genetic Data Generated from Virus–Host Complexes Obtained by Membrane Co-Immobilization Are Equivalent to Data Obtained from Tangential Filtrate Virus Concentrates and Virus Cultures." **Virus Genes** 48, no. 1 (October) 2013; 160–67. https://doi.org/10.1007/s11262-013-0999-7.

[83] I. Herbet, and D. Jérôme. n.d. "Engaging Armed Groups at the International Committee of the Red Cross: Challenges, Opportunities and COVID-19." **International Review of the Red Cross**, 1–11. Accessed December 2021; 2. https://doi.org/10.1017/S1816383121000588.

[84] C. Lin, "Policy Decisions and Use of Information Technology to Fight Novel Coronavirus Disease, Taiwan." **Emerging Infectious Diseases** 26, no. 7 (July) 2019, 2020; https://doi.org/10.3201/eid2607.200574.

[85] P. Jones *et al.*. "Information Technology Coding Systems in the Emergency Department: It Is Not the Tools, It Is How We Use Them." **Emergency Medicine Australasia** 31, no. 5 (September) 2019; 700–701. https://doi.org/10.1111/1742-6723.13378.

[86] I. Abu-elezz. 2020. "The Benefits and Threats of Blockchain Technology in Healthcare: A Scoping Review." **International Journal of Medical Informatics** 142, no. October (October): 104246. https://doi.org/10.1016/j.ijmedinf.2020.104246.

[87] C. P. Haskew *et al.*. "A Standardized Health Information System for Refugee Settings: Rationale, Challenges and the Way Forward." **Bulletin of the World Health Organization** 88, no. 10 (October) 2010; 792–94. https://doi.org/10.2471/blt.09.074096.

[88] I. Asangansi.. "Understanding HMIS Implementation in a Developing Country Ministry of Health Context - an Institutional Logics Perspective." **Online Journal of Public Health Informatics** 4, no. 3 (December) 2012; https://doi.org/10.5210/ojphi.v4i3.4302.

[89] K. Ehrenreich, and K, Katrina. "Prenatal Care as a Gateway to Other Health Care: A Qualitative Study." **Women's Health Issues**, October 2022; https://doi.org/10.1016/j.whi.2022.08.006.

[90] I.T. Adeleke, *et al*,. "Information Technology Skills and Training Needs of Health Information Management Professionals in Nigeria: A Nationwide Study." **Health Information Management Journal** 44, no. 1 (March) 2020; 30–38. https://doi.org/10.1177/183335831504400104.

[91.] M. Edwards-Schachter. 2018. "The Nature and Variety of Innovation." **International Journal of Innovation Studies** 2, no. 2 (June): 65–79. https://doi.org/10.1016/j.ijis.2018.08.004.

[92.] World Health Organization. 2022. "Home." Who.int. 2022. hwttps://ww.who.int

[93.] C. Guo. 2021. "Theoretical Analysis of the Impact of Technological Innovation and Social Responsibility on Financial Performance." **Journal of Innovation and Social Science Research** 8, no. 8 (August): 138–40. https://doi.org/10.53469/jissr.2021.08(08).27.

[94.] X. Wang *et al* 2019. "Impact of Telemedicine on Healthcare Service System Considering Patients' Choice." **Discrete Dynamics in Nature and Society** 2019, no. February (February): 1–16. https://doi.org/10.1155/2019/7642176.

[95.] S. Lee, and Yu, Soyoung. 2021. "Effectiveness of Information and Communication Technology (ICT) Interventions in Elderly's Sleep Disturbances: A Systematic Review and Meta-Analysis." **Sensors** 21, no. 18 (January): 6003. https://doi.org/10.3390/s21186003.

[96.] B. D. Goodman, *et al.* "Bridging to the Cloud: Solution Design Trends Helping 'Legacy' Systems Leverage Cloud Computing." **2010 13th IEEE International Conference on Computational Science and Engineering**, December 2010. https://doi.org/10.1109/cse.2010.62.

[97.] C, Wang.. "Exploring Health Information Exchange through a System of Systems Framework." **International Journal of Applied Research on Public Health Management** 5, no. 2 (July) 2020; 1–12.

[98.] S. Y. Liang. *et al.* "Impact of Physician Practice Style on Costs, Clinical Quality, Patient Experience, Physician Productivity, and Physician Time." **Journal of Patient-Centered Research and Reviews** 4, no. 3 (August) 2017; 153–54. https://doi.org/10.17294/2330-0698.1480.

[99.] A. Winter, *et al.*. "Smart Medical Information Technology for Healthcare (SMITH)." **Methods of Information in Medicine** 57, no. S 01 (July) 2018; e92–105. https://doi.org/10.3414/ME18-02-0004

[100.] O. Ibarra-Barrueta *et al.*. "Implementation of a Pharmacy E-Inter consultation Integrated in Patient Medical Record." **European Journal of Hospital Pharmacy** 28, no. e1 (November) 2020; e124–27. https://doi.org/10.1136/ejhpharm-2020-002224

[101.] S. Smagulov, and S. Viktoriya.. "Digital Transformation of Healthcare." **Intellectual Archive** 8, no. 1 (SI) (March) 2019 https://doi.org/10.32370/ia_2019_01_si_1.

[102.] L. Arendt. “Barriers to ICT Adoption in SMEs: How to Bridge the Digital Divide?” **Journal of Systems and Information Technology** 10, no. 2 (August) 2008; 93–108. https://doi.org/10.1108/13287260810897738.

[103.] J. Amlung *et al.*. “Modernizing Health Information Technology: Lessons from Healthcare Delivery Systems.” **JAMIA Open** 3, no. 3 (October) 2020; 369–77. https://doi.org/10.1093/jamiaopen/ooaa027.

[104.] F. A, Williams, and I. Zachary.“Public Health Delivery in the Information Age: The Role of Informatics and Technology.” **Perspectives in Public Health** 139, no. 5 (February) 2019; 236–54. https://doi.org/10.1177/1757913918802308.

Chapter Three

Methodology

3.1 Study Design

A cross-sectional design was adopted for this study.

3.2 Study Setting

The study area for this study is the University College Hospital (UCH), Ibadan. The UCH is a tertiary hospital located in Ibadan North Local Government, one of the 33 local government areas in Oyo State, with staff strength of 6,353 personnel and a 891-bed capacity as at May 2022 focusing on medical care, training and research.

University College Hospital (U.C.H) is a Research, Training, and services oriented Tertiary care Institution in West Africa which was established by an ACT of parliament on November no 26 in 1952 in response to the need for the training of medical and other healthcare professionals, medical students and Para-medical students following the establishment of faculty of medicine at University of Ibadan, for the country and West Africa Sub-Region.

The University College Hospital (UCH) is strategically located in Ibadan North Local Government, Ibadan. It was carried out in UCH because is regarded as the flagship tertiary healthcare institution offering world class training, research and services. The mission of the hospital is to provide excellent, prompt affordable, and accessible healthcare in a conducive environment with high-quality health personnel's who are also into research.

The Health Information Department of the University College Hospital Ibadan is responsible for organization of the health records library and setting up of the required various units in the clinics, casualty, general outpatients and the wards. Health Records Officers design various health related forms in conformity with the standard of World Health Organization (WHO) and to suit the numbering and filing system suitable of the

hospital. The department has a number of trained health information managers who are making use of IT products in delivering health information management practice, such as health in the box, Ajimatic software and All-purpose Management Information System (APMIS) etc.

Source: UCH HR, 2022

3.3 Study Population

The population for this study were healthcare workers in the University College Hospital, Ibadan.

3.3.1 Inclusion Criteria

This study included healthcare workers using IT product in the hospital who are employed as permanent staff in University College Hospital regardless of their cadre and clinic or service area posted to.

3.3.2 Exclusion Criteria

All healthcare workers who were not present during the time of the data collection process and those who declined consent during the period of data collection, those who are not using IT products, non-clinical and administrative staff (secretaries, typists, clerical staff, cleaners, security) and students in the hospital were excluded from the study.

3.4 Sample Size Determination

The sample size for this study was determined using the formulae:

$$n = \frac{Z^2 P(1-P)}{e^2}$$

Where:

P = 0.5.

n = calculated sample size,

Z= (1.96) standard normal deviate at 95% confidence interval,

P = proportion of respondents that have a good knowledge and perception Electronic Health Record,

Q = (1-P) the proportion of respondents that does not have a good knowledge and perception of EHR, and

e = precision level 5%=0.05

Note: this probability value of 0.5 was used for this study because no previous researcher has reported the adoption rate of Information Technology in HIM practices in Nigeria.

$$n = \frac{3.8416 * 0.5 * 0.5}{0.05^2}$$

$$n = \frac{0.9604}{0.0025}$$

$$n = 384$$

384+ 10% of 384 (considering the non-response rate)

384+38.4

422

Table 1: Sample Size Selection across the Different Cadres in the Hospital

S/N	Profession	Number of Professionals	Percentage (%)	Sub Total	
1	Nursing	1538	49	207	
2	Doctors	1045	33	141	
3	HIM	150	5	20	
4	laboratory Scientists	192	6.1	26	
5	Pharmacist	100	3.2	13	
6	Physiotherapist	53	1.7	7	
7	Imaging Scientists	20	0.6	3	
8	Anesthetics	32	1.1	3	
9	Clinical Psychologists	5	0.2	1	
10	Community Health Officer	4	0.1	1	
	Total	3139	100	422	N=3, 139

Source: Human Resource Department of UCH, 2022

3.5 Sample Size.

Based on the above sample size computation, a total of 422 healthcare workers of University College Hospital were sampled for the study.

3.6 Sampling Method

A multistage sampling technique was adopted for the study for different departments in the hospital in the following stages

Stage 1: Stratified sampling was adopted where the respondents were grouped into different strata. The departments were categorized into both clinical and non-clinical departments within the hospital

Stage 2: Simple random sampling was used to randomly select the respondents from the respective departments where individuals had an equal chance of being selected from the target population.

3.7 Data Collection Instrument

Information was obtained from respondents using adapted semi- structured, self-administered questionnaire containing closed ended questions comprising of the following sections:

Section A: Socio-demographic data of respondents

Section B: Attitude towards IT application in HIM practice

Section C: Benefits of application of information technology

Section D: The application of IT in HIM practice

Section E: Challenges associated towards IT application

3.8 Data Collection Procedure

Data were collected using an adapted questionnaire, the research tools was distributed and retrieved by the principal researcher. All data collected were cleaned and entered into SPSS software version 25 for statistical analysis. The consent was individually obtained from potential participants before the administration of the questionnaire. Names and other personal identifiers were not used and respondents were assured that all information provided would be confidential and used for only research purposes.

3.9 Reliability and Validity

Questionnaire was adapted by the researcher, vetted and corrected by the supervisor in other to improve the precision of the instrument measurement and a pre-test survey was conducted in a separate institution (at Jaja clinic).

3.10 Ethical Consideration

The approval for the research was obtained from the Lead City University research ethics committee (LCU-REC/22/149) and the UI/UCH research ethics committee of the University Collage Hospital Ibadan (UI/EC/22/0307) respectively. Voluntary informed consent was individually obtained from potential participants before the administration of the questionnaire. Names or other personal identifiers were not used while only serial numbers were used on the questionnaires as means of identification and respondents were assured that all information provided shall be treated confidentially and used only for research purposes.

3.11 Data Management

Data management activities for this study includes data entering, cleaning, coding, missing values, and outliers handling and analysis was done with Statistical Package for Social Sciences (SPSS) statistical software (version 25.0). Descriptive statistics of the qualitative

and quantitative variables was analyzed using frequency and percentage count, and mean and standard deviation respectively. Data were represented in tables and charts. In addition, bivariate analysis involving the use of chi-square was adopted to test the associations between the dependent and independent variables, and p-values <0.05 was considered statistically significant.

The attitude was categorized into positive and negative attitude, participants with total scores of 60% and above were considered to have a positive attitude while respondents with less than 60% were considered to have negative attitude. This was adopted from a study conducted by [1] on attitude, knowledge and utilization of information technology among healthcare professionals in Ile-Ife, Nigeria where attitudinal scores above 60% were rated as "good" and scores below 60% were rated as poor.

End Notes

1. I.S. Bello, et al. Knowledge and utilization of Information Technology among health care professionals and students in Ile-Ife, Nigeria: a case study of a university teaching hospital. *Journal of medical Internet research*, *6*(4), e45. 2004 https://doi.org/10.2196/jmir.6.4.e45

2. W.G. Cochran. Sampling techniques 3rd Ed. 1977. New York: John Wiley & Sons
3. L. kish. Survey Sampling 1965. New York: John Wiley and Sons, inc.

Chapter Four

Results and Discussion of Findings

4.1 Demographic Data Analysis

Four hundred and Twenty- Two (422) questionnaires were distributed to the healthcare workers in the University College Hospital. Four hundred and one (401) questionnaires were properly completed and returned by the respondents, amounting to a response rate of 95.9%.

Demographic Characteristics of the Respondents

The result of this analysis shows that majority of the respondents 164(40.9%) are between the ages of 40-49, only 25(6.2%) were between the ages of 20-29 years with mean age of 40.20±7.18. 234 representing (58.4%) of the respondents were females. It's also shows that 275(68.6%) were Christians while only 9(2.2%) are classified under others. Majority of the respondents 196(48.9%) are nurses and only 1 clinical psychologist and community health officer (0.2%) respectively. Majority of the respondents 296 (73.8%) obtained HND/BSC and only 2(0.5%) had national diploma. About 176(43.9%) of the respondents had between 1 to 5 years work experience, only 42 (10.5%) of the respondents had 15 years and above work experience. About 63.3% of the respondents (254) are from the various outpatient's department of the hospital and only 15 are from other units.

Table 4.1: Distribution of Respondents' Demographic Characteristics

Variable	Frequency	Percent (%)	Mean()	Std()
Age			40.20	7.18
Age Group (Years)				
20-29	25	6.2		
30-39	161	40.1		
40-49	164	40.9		
50-59	51	12.7		
Sex				
Male	167	41.6		
Female	234	58.4		
Religion				
Christianity	275	68.6		
Islam	126	31.4		
Cadre				
Doctors	131	32.7		
Nurse	196	48.9		
Medical Lab scientist	26	6.5		
Health Information Management	20	5.0		
Physiotherapist	7	1.7		
Pharmacists	13	3.2		
Radiographer	3	0.7		
Clinical Psychologist	1	0.2		
Community Health officer	1	0.2		
Others	3	0.7		

Source: Researcher's Survey (2022).

Table 4.2: Distribution of Respondents' Demographic Characteristics

Variable	Frequency	Percent (%)	Mean()	Std()
Highest Educational attainment				
ND	2	0.5		
HND/BSC	296	73.8		
MSC/PHD	103	25.7		
Length of Service (years)			7.71	6.02
1-5	176	43.9		
6-10	132	32.9		
11-15	51	12.7		
>15	42	10.5		
Unit				
Outpatients	254	63.3		
Emergency	25	6.2		
Records Department	10	2.5		
Ward	44	10.9		
Laboratory	33	8.2		
Radiology	20	4.9		
Others	15	3.7		

Source: Researcher's Survey (2022)

Distribution of Respondents' who Owned a Personal Computer

The result shows majority of the respondents had a personal computer (80.3%), while 19.7% do not own personal computer.

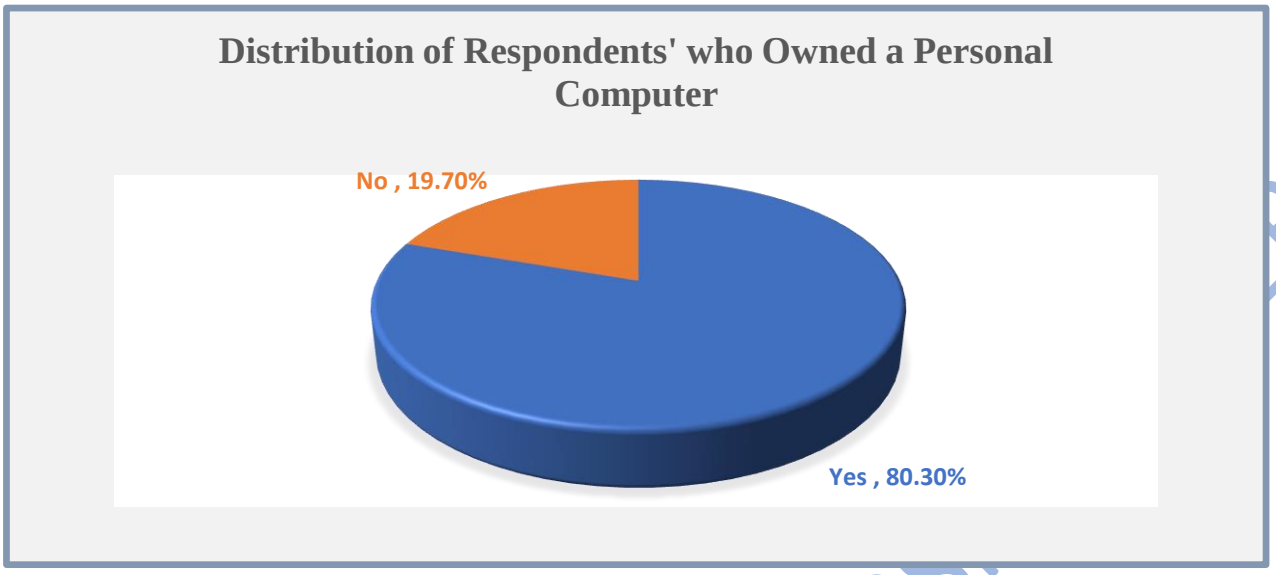


Figure 4.1: Distribution of Respondents' who Owned a Personal Computer

Distribution of Respondents' Who Owned a Mobile Tablet

Figure 4.2 shows that majority of the respondents (63.1%) own a mobile tablet, while 36.9% do not own a mobile tablet.

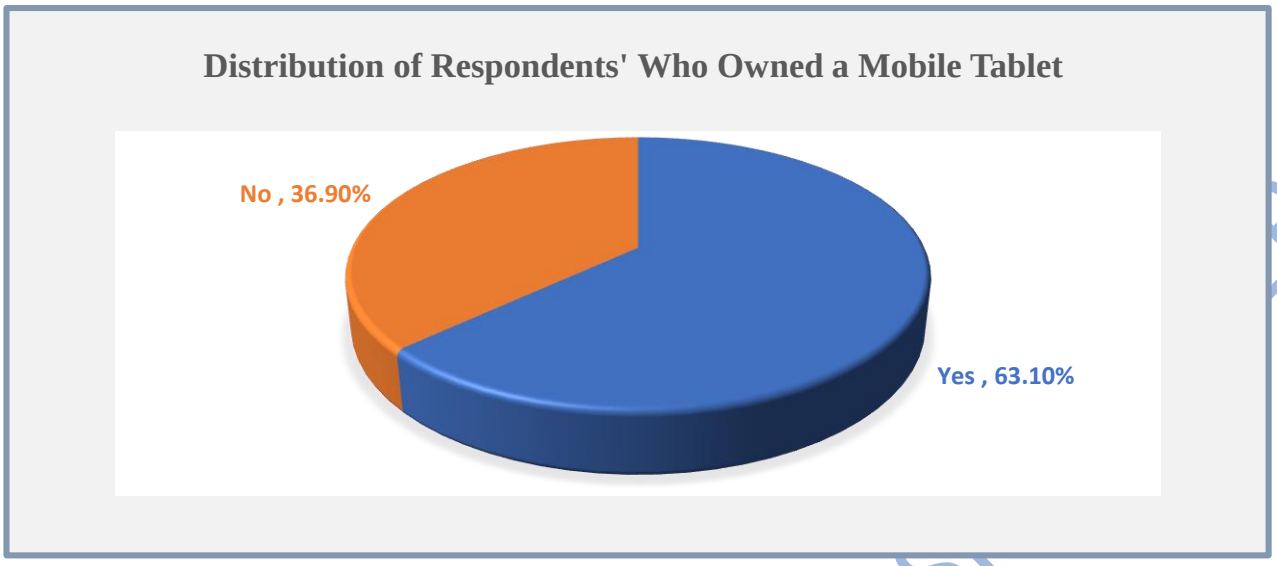


Figure 4.2: Distribution of Respondents' who Owned a Mobile Tablet

Respondents' Basic Computer Skills

This result of the analysis shows that majority of the respondents of this study 86.3% uses Microsoft word, half of the respondents 50.6% uses Microsoft Access, more than half of the respondents of this study 66.3% uses Microsoft excel, 63.6% of the respondents uses Microsoft Power Point and not up to half of the respondents 44.1% of this study do use SPSS respectively.

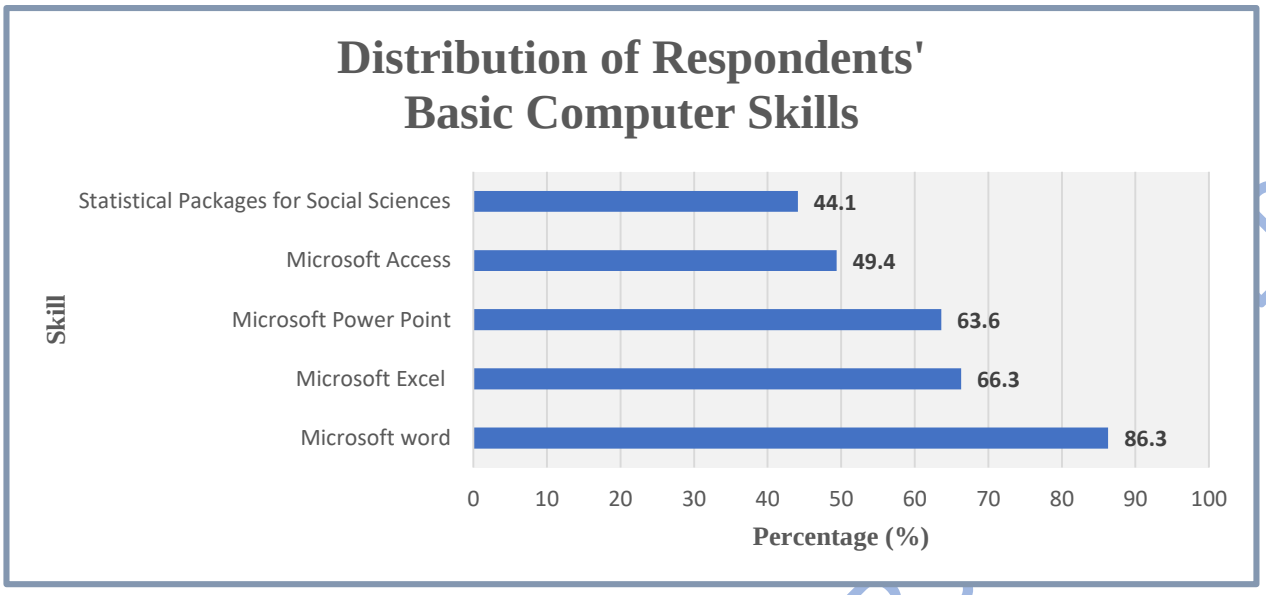


Figure 4.3: Distribution of Respondents' Basic Computer Skills

Attitude towards IT Application in Healthcare Delivery

The result of this analysis shows that of the 401 respondents, 320(79.8%) of the respondent accepted that application of IT in HIM improves quality of care, 223(55.6%) consented that application of IT would result to retrenchment of HIM personnel, 344(85.8%) concluded that application of IT in HIM reduces medical errors, 354 (89.3%) said yes that it's important to apply IT and its product in delivering healthcare services, 299(74.6%) claimed that use of IT in HIM makes life easier at work, 232(57.9%) said yes that privacy of patients information is compromised with application of IT, 213(53.1%) agreed that application of IT products and innovations distorts the flow of work in my office, 352(87.8%) said yes that application of IT products and innovations improve medical outcome.

Table 4.3: Attitude towards IT Application in Healthcare Delivery

Items	Yes N (%)	No N (%)	I don't Know N (%)
Application of IT in HIM improves quality of care	320 (79.8%)	64 (16.0%)	17 (4.2%)
Application of IT would result to retrenchment of HIM personnel	223 (55.6%)	158 (39.4%)	20 (5.0%)
The Quality of data for clinical decision making is improved when IT products are implemented in HIM	344 (85.8%)	43 (10.7%)	14 (3.5%)
Application of IT in HIM reduces medical errors	337 (84.0%)	50 (12.5%)	14 (3.5%)
Is it important to apply IT and its product in delivery healthcare services?	354 (89.3%)	34 (8.5%)	9 (2.2%)
Application of IT innovations and products is a difficult task that comes with many challenges	299 (74.6%)	87 (21.7%)	15 (3.7%)
I think the use of IT in HIM makes life easier at work	345 (86.0%)	50 (12.5%)	6 (1.5%)
Privacy of patients' information is compromised with application of IT	232 (57.9%)	148 (36.9%)	21 (5.2%)
Application of IT products and innovations distorts the flow of work in my office	213 (53.1%)	177 (44.1%)	11 (2.7%)
Application of IT products and innovations improves medical outcome	352 (87.8%)	49 (12.2%)	0

N: Number of Respondents

Source: Researcher's Survey (2022)

Healthcare Workers' Attitude Towards Application of IT

The figure below shows that majority of the respondents (89.3%) had good or positive attitude towards the use of IT while few of the respondents (10.7%) had poor attitude towards IT usage.

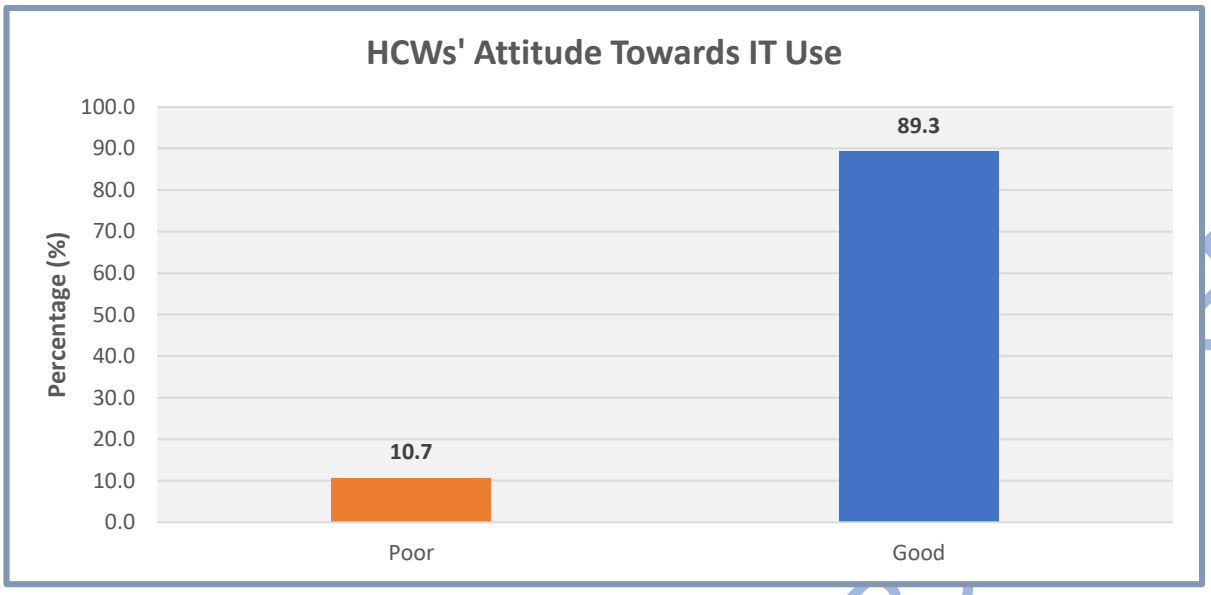


Figure 4.4: Healthcare Workers' Attitude Towards Application of IT

Benefits of Application of Information Technology (IT) in HIM

The result of this analysis shows that of the 401 respondents of this study, 397(99.0%) said yes that Application of information Technology e.g. electronic health records (EHR) improves the quality of my work in providing better services, 401(100%) said yes that Application of IT innovations allows me to accomplish tasks more quickly, 401(100%) said yes that IT allows me to accomplish more work than would otherwise be possible, 345(88.3%) said yes that IT helps to enhance my overall effectiveness in my job, 401(100%) said yes that Application of IT increases patient convenience, 357(89.0%) said yes that Application of IT helps to reduce waiting time, 286(71.3%) said yes that IT application reduces cost, 401(100%) said yes that Application of IT products improves access to healthcare service, 341(85.0%) said yes that Information Technology development allows multiple access to patients' information for healthcare service, 354(88.3%) said yes that IT enhances patients' data storage and retrieval and 401(100%) said yes that IT increases the overall efficiency of health care delivery.

Table 4.4: Benefits of Application of Information Technology (IT) in HIM

Items	Yes *N (%)*	No *N (%)*
Application of IT e.g., electronic health records (EHR) improve the quality of my work in providing better services.	397 (99.0%)	4 (1.0%)
IT innovations can give me greater control over my work schedule.	401 (100.0%)	0
Application of IT innovations allows me to accomplish tasks more quickly	401 (100.0%)	0
IT allows me to accomplish more work than would otherwise be possible	401 (100.0%)	0
IT helps to enhance my overall effectiveness in my job	354 (88.3%)	47 (11.7%)
Application of IT increases patient convenience	401 (100%)	0
Application of IT helps to reduce waiting time	357 (89.0%)	44 (11.0%)
IT application reduces cost	286 (71.3%)	115 (11.0%)
Application of IT products improves access to healthcare service	401 (100%)	0
Information Technology development allows multiple access to patients' information for healthcare service	341 (85.0%)	60 (15.0%)
IT enhances patients' data storage and retrieval	354 (88.3%)	47 (11.7%)
It increases the overall efficiency of health care delivery.	401 (100%)	0

N: Number of Respondents

Source: Researcher's Survey (2022).

Benefit of Application of IT in HIM Practice

It shows that all the respondents (100.0%) agreed that IT application in HIM practice is highly beneficial

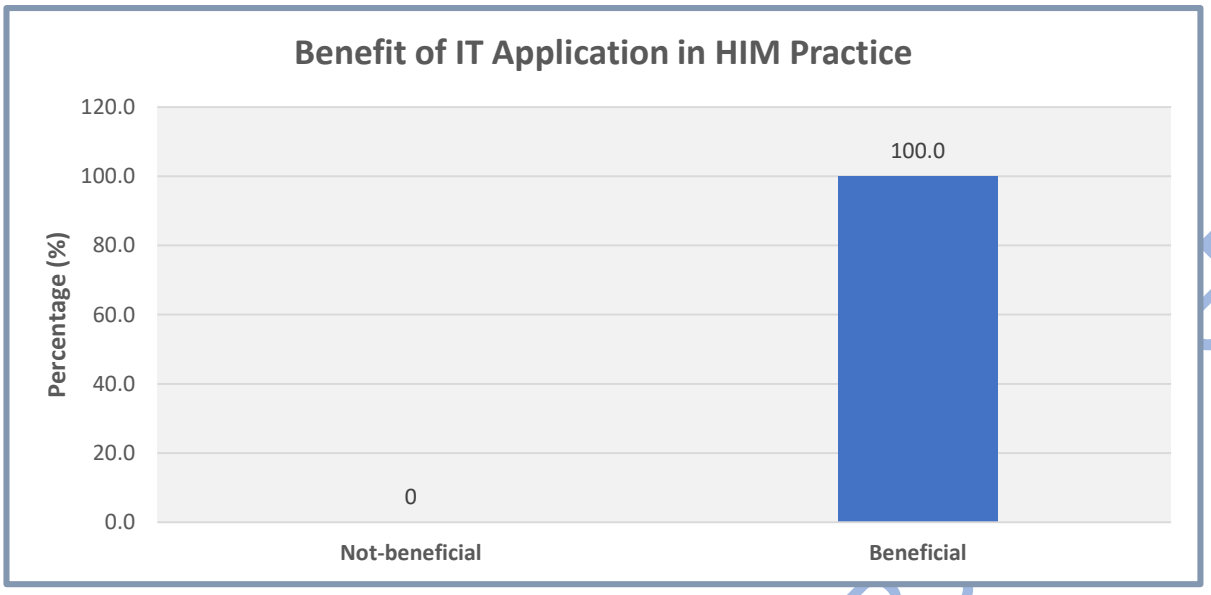


Figure 4.5: Benefit of Application of IT in HIM Practice

Challenges with the Application of IT in UCH

The result of this analysis shows that out of the 401 respondents, 365(91.0%) agreed that Inadequate training is one of the challenges of IT, 377(94.0%) claimed inadequate IT facilities is another challenge of IT, 369(92.0%) said yes that insufficient knowledge on the use of IT tools is a great challenge to IT in HIM, 350(87.3%) agreed that lack of access to IT tools is one of the challenges of IT application in HIM, 348(86.8%) agreed that affordability is another challenge of IT application in HIM practice, 299(74.6%) said yes that privacy is one of the challenges of use of IT in HIM practice.

Table 4.5: Challenges with the Application of IT in UCH

Items	Yes *N (%)*	No *N (%)*
Inadequate training	365 (91.0%)	36 (9.0%)
Inadequate IT facilities	377 (94.0%)	24 (6.0%)
Insufficient knowledge on the use of IT tools	369 (92.0%)	32 (8.0%)
Lack access to IT tools	350 (87.3%)	51 (12.7%)
Affordability	348 (86.8%)	53 (13.2%)
privacy issues	299 (74.6%)	102 (25.4)
Security issues	308 (76.8%)	93 (23.2%)
Failure of equipment	347 (86.5%)	54 (13.5%)
Old IT tools	369 (92.0%)	32 (8.0%)
Interoperability	356 (88.8%)	45 (11.2%)
Lack of management support	331 (82.5%)	70 (17.5%)
Changes in software	347 (86.5%)	54 (13.5%)
Changes in hardware	335 (83.5%)	66 (16.5%)

N: Number of Respondents

Source: Researcher's Survey (2022)

Challenges Against Application of IT in HIM Practice

The figure below shows that 96.3% of HCWs believed that the healthcare facility is challenged in terms of application of IT, while 3.7% believed that the facility is not challenged

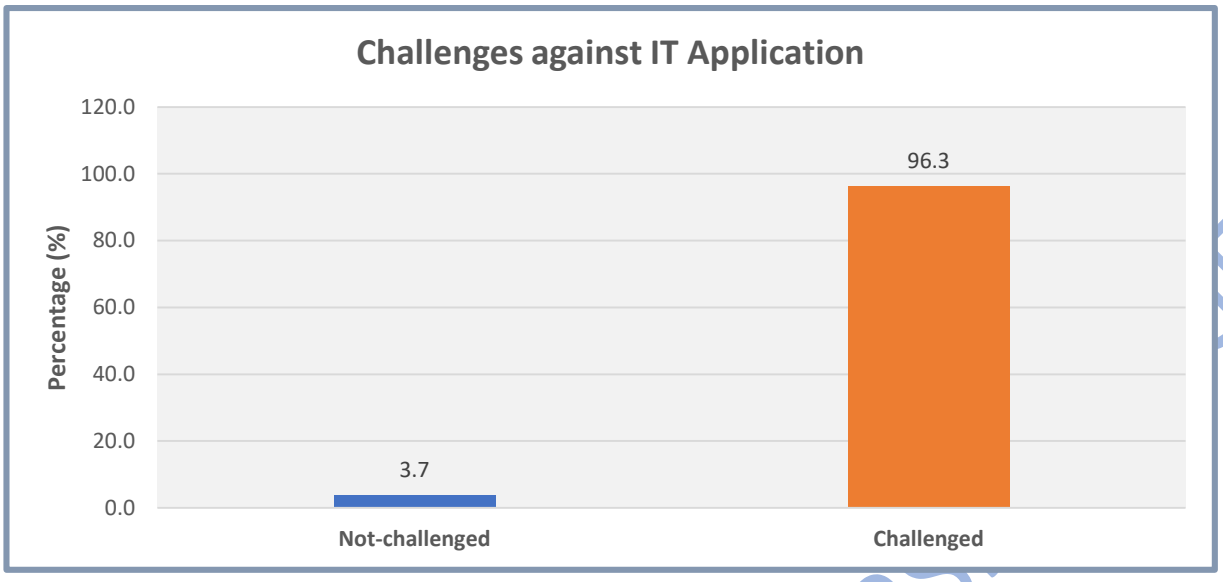


Figure 4.6: Challenges against Application of IT in HIM Practice

Application (the Use) of IT Innovations and Products in UCH

The result of this analysis shows that of the 401 total respondents 397(99.0%) said yes that they do you make use of IT ideas and products to store and manage patients' information, 324(80.8%) said yes that IT products like computer or mobile devices be used to exchange official information with other professionals, 395(98.5%) said yes that they do make use of IT innovations to design forms for patients' data collection, 342(85.3%) said yes that computer applications can be used to perform clinical coding tasks, 310(77.3%) said yes that they do use statistical packages such as Microsoft excel, SPSS etc to carry out data analysis task, 329(82.0%) said yes that they make use of IT software to manage patients' appointment, 322(80.3%) said yes that IT is used to enhance record uniformity designed to reduce practice variations, 298(74.3%) said yes that they use IT innovations to track and retrieve patient records, 333(83.0%) said yes that they make use of IT skills to eliminate duplication of patients' records, and 297(74.1%) said yes that they apply IT skills to collect and analyses information relating to episode of inpatient treatment and bed utilization.

Table 4.6: Application of IT Innovations and Products in UCH

Items	Yes *N (%)*	No *N (%)*
Do you make use of IT ideas and products to store and manage patients' information?	397 (99.0%)	4 (1.0)
Can IT products like computer or mobile devices be used to exchange official information with other professionals?	324 (80.8%)	77 (19.2%)
Do you use IT innovations to design forms for patients' data collection?	395 (98.5%)	6 (1.5%)
Can computer applications be used to perform clinical coding tasks?	342 (85.3%)	59 (14.7%)
Do you use statistical packages such as Microsoft excel, SPSS etc. to carry out data analysis task?	310 (77.3%)	91 (22.7%)
Do you make use of IT software to manage patients' appointment	329 (82.0%)	72 (18.0%)
IT is used to enhance record uniformity designed to reduce practice variations?	322 (80.3%)	79 (19.7%)
Do you use IT innovations to track and retrieve patient records?	298 (74.3%)	103 (25.7%)
Do you make use of IT skills to eliminate duplication of patients' records?	333 (83.0%)	68 (17.0%)
Do you apply IT skills to collect and analyses information relating to episode of inpatient treatment and bed utilization?	297 (74.1%)	104 (25.9%)

N- Number of Respondents

Source: Researcher's Survey (2022)

Application of IT in HIM Practice

The figure below shows that 92.0% of HCWs had good application of IT, while 8.0% had poor application.

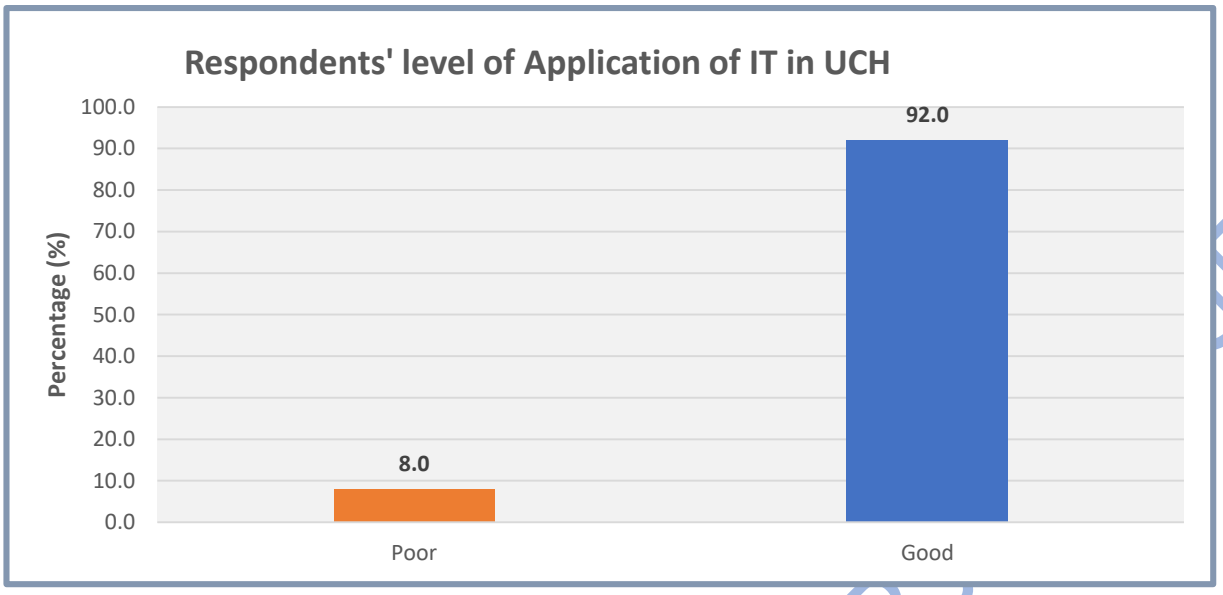


Figure 4.7: Application of IT in HIM Practice

Association Between Respondents' Demographic Characteristics and Attitude Towards Use of Computer

Table 4.6 shows the association between respondents' demographic characteristics and attitude towards application of IT in HIM practice. At 0.05 level of significance, length of service (*X^2 Value=6.145, P-value=0.046*) significantly correlate with the attitude towards IT application. Whereas, age (*X^2 Value=2.603, P-value=0.457*), sex (*X^2 Value=1.637, P-value=0.201*) and highest level of education (*X^2 Value=2.233, P-value=0.135*), religion (*X^2-Value=1.490, P-value=0.222*), respondents' cadre (*X^2 Value=4.399, P-value=0.111*) do not significantly influence the attitude towards application of IT.

Table 4.7: Association Between Respondents' Demographic Characteristics and Attitude Towards Use of Computer

	Attitude				
	Positive	**Negative**			
Variable	***N (%)***	***N (%)***	**Total**	**X^2 Value**	**p-value**
Age group (Years)				2.603	0.457
20-29	21(84.0)	4 (16.0)	25		
30-39	147(91.3)	14 (8.7)	161		
40-49	143 (87.2)	21 (12.8)	164		
50-59	47(92.2)	4 (7.8)	51		
Sex				1.637	0.201
Male	153 (38.2)	14 (61.8)	167		
Female	205 (51.1)	29 (48.9)	234		
Religion				1.490	0.222
Christianity	242 (88.0)	33 (12.0)	275		
Islam	116 (92.0)	10 (8.0)	126		
Cadre					
Doctors	123 (94.0)	8 (16.0)	131	4.399	0.111
Nurse	170 (86.7)	26 (13.3)	196		
Others	65 (87.8)	9 (12.2)	74		
Highest educational attainment				2.233	0.135
ND/HND/BSC	262 (88.0)	36 (12.0)	298		
MBBS/MSC/PHD	96 (93.2)	7 (6.8)	103		
Length of service (years)				6.145	0.046*
0-4	134 (93.7)	9 (6.3)	143		
5-10	129 (88.9)	16 (11.1)	145		
10 and above	95 (84.0)	18 (16.0)	113		

N- Number of Respondents

** - Significant at 5% level of significance.*

Source: Researcher's Survey (2022).

Association Between Respondents' Demographic Characteristics and Application of IT

Table shows the relationship between the respective items and the application of information technology in health information practice. There was a statistically significant association between age and application of IT age (*X^2 Value=9.934, P-value=0.031*), cadre (*X^2 Value25.313, P-value=0.000*), whereas, age (*X^2 Value=2.603, P-value=0.457*), sex (*X^2 Value=0.246, P-value=0.620*), highest level of education (*X^2 Value=0.009, P-value=0.926*), religion (*X^2-Value=0.665, P-value=0.415*) and length of service (*X^2 Value=3.125, P-value=0.210*), do not significantly influence the attitude towards application of IT.

Table 4.8: Association Between Respondents' Demographic Characteristics and Use of IT in HIM Practice

Variables		Good *N (%)*	Poor *N (%)*	Total Total	X^2 X^2 Value	P p-value
Age group (years)						
	20-29	22 (88.0)	3 (12.0)	25	9.934	0.031*
	30-39	154 (95.6)	7 (4.4)	161		
	40-49	151 (92.1)	13 (7.9)	164		
	50-59	42 (82.4)	9 (17.6)	51		
Sex						
	Male	155 (92.8)	12 (7.2)	167	0.246	0.620
	Female	214 (91.5)	20 (8.5)	234		
Religion						
	Christianity	251 (91.3)	24 (8.7)	275	0.665	0.415
	Islam	118 (93.7)	8 (6.3)	126		
Cadre						
	Doctors	131 (100.0)	0 (0.0)	131	25.313	0.000*
	Nurse	167 (85.2)	29 (14.8)	196		
	Others	71 (95.9)	3 (4.1)	74		
Highest educational attainment					0.009	0.926
	HND/BSC	212 (71.1)	86 (28.9)	298		
	MSC/PHD	74 (71.8)	29 (28.2)	103		
Length of Service (years)					3.125	0.210
	0-4	132 (92.3)	11 (7.7)	143		
	5-9	137 (94.5)	8 (5.5)	145		
	10 and above	100 (88.5)	13 (11.5)	113		

N- Number of Respondents

** - Significant at 5% level of Significance.*

Source: Researcher's Survey (2022).

Association Between Challenges and Application of IT in HIM Practice

Table 4.8 shows the association between Challenges and Application of IT in HIM Practice. At 0.05 level of significance, religion (X^2-*Value=7.829, P-value=0.020*), lack of access to IT tools (*P-value=0.023*), privacy issue (X^2 *Value=6.750, P-value=0.009*), Failure of IT equipment or tools (*P-value=0.013*), Lack of management support (*P-value=0.007*), Changing of software (*P-value=0.013*), Changing of hardware (*P-value=0.009*) significantly associate with the challenges and IT application.

Table 4.9: Association Between Challenges and Application of IT in HIM Practice

		Application of IT in HIM Practice			X^2 / Exact-test (-)	p-value
		Poor	*Good*	*Total*		
Inadequate Training	*Yes*	31	334	365	-	*0.339*
	No	1	35	36		
Inadequate IT Facilities	*Yes*	31	346	377	-	*0.709*
	No	1	23	24		
Insufficient knowledge on IT use	*Yes*	31	338	369	-	*0.496*
	No	1	31	32		
Lack of access to IT tools	*Yes*	32	318	350	-	*0.023**
	No	0	51	51		
Affordability of IT tools	*Yes*	29	319	348	-	*0.785*
	No	3	50	53		
Privacy issue	*Yes*	30	269	299	6.750	*0.009**
	No	2	100	102		
Security issue	*Yes*	31	277	308	7.861	*0.005**
	No	1	92	93		
Failure of IT equipment or tools	*Yes*	32	315	347	-	*0.013**
	No	0	54	54		
Outdated or old IT tools	*Yes*	29	340	369	-	*0.732*
	No	3	29	32		
Interoperability issue	*Yes*	31	325	356	-	*0.236*
	No	1	44	45		
Lack of management support	*Yes*	32	299	331	7.354	*0.007**
	No	0	70	70		
Changing of software	*Yes*	32	315	347	-	*0.013**
	No	0	54	54		
Changing of hardware	*Yes*	32	303	335	6.851	*0.009**
	No	0	66	66		

Source: Researcher's Survey (2022).

Hypothesis Testing

Hypothesis 1:

H_0: There is no association between attitude towards IT and application of IT in HIM practice

The results in the table 4.7 above shows that larger proportion of HCWs with positive attitude towards application of IT has good use of IT innovations and skills. Despite this large difference, there is no significant statistical difference between the levels of application of IT and Attitude towards IT, at 0.05 level of significance with p-value=0.557.

Decision Rule: Fail to reject H_0, if p-value is greater 0.05

Conclusion: Since, p-value=0.557 is greater than 0.05 level of significance. We conclude that there is no association between benefit of IT and application of IT in HIM

Table 4.10: Association Between Attitude and Application of IT in HIM Practice

	Application of IT in HIM				
Statement	**Poor OV (EV)**	**Good OV (EV)**	**Total**	**Fisher's Exact Test**	**P-value**
Attitude towards IT					
Negative	2 (3.4)	41 (39.6)	43 (43.0)	0.727	*0.557*
Positive	30 (28.6)	328 (329.4)	358 358.0		

N- Number of Respondents

** - Significant at 5% level of Significance.*

Source: Researcher's Survey (2022).

Hypothesis 2

H_0: There is no association between IT challenges and application of IT in HIM practice

Finally, the results of analysis in table 4. Above shows that 91.7% of those respondents that agreed that their health institution is not challenged in terms IT application had good application of IT in their respective fields.

Decision Rule: Fail to reject H_0, if p-value is greater 0.05

Conclusion: Since, p-value=0.621 is greater than 0.05 level of significance. We conclude that there is no association between challenges of IT and application of IT in HIM

Table 4.11: Association Between Challenges and Application of IT in HIM Practice

	Application of IT in HIM				
Statement	**Poor OV (EV)**	**Good OV (EV)**	**Total**	**Fisher's Exact Test**	**P-value**
IT Application Challenges					
Challenged	0 (1.2)	15 (13.8)	15 (15.0)	1.348	*0.621*
Not challenged	32 (30.8)	354 (355.2)	386 (386.0)		

N- Number of Respondents

** - Significant at 5% level of Significance.*

Source: Researcher's Survey (2022).

4.2 Discussion of Findings

The application of information technology in health information management practice (HIM) is a moved from paper base to electronic health record system using computer application and packages.

The findings of this study are similar to a study that reported (86%) positive attitudes on the use of digital health Technology among healthcare workers providing maternal healthcare services in Tanzania[1].

The findings of this study are similar to a study that reported that HIT is increasingly viewed as the most promising tool for improving the overall quality, safety and efficiency of the health delivery system[2].

The finding of our study is similar to a study conduct the in Singapore that reported Information Technology (IT) has transformed the ways modern healthcare systems used to acquire, store, access and communicate medical information[3].

The finding of our study is similar to a study conduct the in Nigeria that reported that technology and human resource are the challenges or barriers affecting use of IT[4].

Endnotes

1. K, Keskinbora, and G. Fatih.. "Artificial Intelligence and Ophthalmology." *Turkish* **Journal of Ophthalmology** 50, no. 1 (January) 2020; 37–43. https://doi.org/10.4274/tjo.galenos.2020.78989.

2. L. A., Huryk. "Factors Influencing Nurses' Attitudes towards Healthcare Information Technology." **Journal of Nursing Management 18**, no. 5 (July): 2010; 606–12

3. I. Klisowska, *et al.* "Information Technology and Its Benefits in Nursing Care of the Patient." **E-Methodology** 5, no. 5 (April) 2019; 24–30. https://doi.org/10.15503/emet.v5i5.523.

4. D. F., Sittig. "Defining Health Information Technology–Related Errors." **Archives of Internal Medicine** 171, no. 14 (July) 2011; 1281. https://doi.org/10.1001/archinternmed.2011.327.

Chapter Five

Conclusion

5.1 Summary of Findings

The study discovered that healthcare workers had a positive attitude toward use of IT in HIM practice. The application of IT in HIM practice was assessed and reported to be good. The benefit of IT in HIM practice was also assed. The challenges associated to the used of IT in HIM practice was assessed.

5.2 Conclusion

The application of Information Technology in Health Information Management practice is a major tool to promoting healthcare practice and to enhance the integrity, reliability and confidentiality of all health-related data. The use of IT has been found to promotes the speed and minimized data lost in healthcare sector. It also aids the exchange of information between healthcare providers and facility, improved data accuracy and promotes clinical documentation of patients' record which is instrumental to better healthcare delivery.

5.3 Recommendations

The recommendations of this study were made to both the government, healthcare workers and the researchers as follows:

1. The government should ensure adequate provision of IT products to facilitates healthcare delivery services
2. Adequate budgetary allocation should be given to the hospitals for acquisition of modern and sophisticated information technology tools needed in the hospitals for effective information management
3. The hospital management should encourage HCWs to practice IT product by providing them with up -to-date training on the application and use of IT products

and skills on the utilizations of IT in HIM practice to improve the healthcare services rendered in the hospital

4. Healthcare workers should be committed to using IT in HIM practice to increase the confidentiality and improved patients' data management
5. Further research on the use of IT in HIM practice should be conducted to be able to documents such information for generalization

5.3.1 Contributions to Knowledge

The findings of this studies have contributed on finding out the following:

1. The study discovered that healthcare workers had a positive attitude toward use of IT in HIM practice.

2. The application of IT in HIM practice was assessed and reported to be good

3. The benefit of IT in HIM practice was also assessed

4. The challenges associated to the use of IT in HIM practice was as well assessed.

5.3.2 Recommendations for Further Research

1. the government and other hospital management should ensure the provision and effective utilization of IT product to facilitate the health information management practice to reduces medical errors.
2. A quantitative study should be conducted on the application of IT in HIM practice across West African States.

Bibliography

E-Books

"5 Benefits of Health Information Technology for Nurses." Ohio University. March 29, 2018.https://onlinemasters.ohio.edu/blog/5-benefits-of-health-information-technology.

"10 Principles of Good Medical Record Keeping | Shredall SDS Group." n.d. Www.shredall.co.uk.https://www.shredall.co.uk/blog/10-principles-of-good-medical-record-keeping.

Abdel-Hameed, Faten S. M. "Information Technology and Assessment.", 2020932–37. https://doi.org/10.1007/978-3-030-10576-1_47.

Alvarez, Richard. "The Electronic Health Record: A Leap Forward in Patient Safety." **Health care Papers** 5, no. 3 (October) 2004. 33–36. https://doi.org/10.12927/hcpap.2004.16862.

Center. "Mobile Medical Applications." U.S. Food and Drug Administration. 2019. https://www.fda.gov/medical-devices/digital-health/mobile-medical-applications.

Cochran., W.G Sampling techniques 3rd Ed. 1977. New York: John Wiley & Sons

"Electronic Health Records Interoperability." n.d. Www.e-Health.standards.org.au. http://www.e-health.standards.org.au/IT014SubjectAreas/EHRInteroperability.aspx.

"Healthcare Knowledge Collection for Clinical Decision Support Systems." *Issues in Information Systems* 2020. https://doi.org/10.48009/1_iis_2010_538-546.

Hira Saeed *et. al.*, "Information and Communication Technology in Higher Education: Online Experience of Faculty." **Information Technology in Industry** 9, no. 2 (April) 2021; 1117–22. https://doi.org/10.17762/itii.v9i2.460.

Icheku, Vincent. "Challenges of Protecting Personal Data and Privacy during Online Teaching and Learning." **Academia Letters**, August (August) 2021. https://doi.org/10.20935/al3083.

Janett, Robert S., and Peter Pano Yeracaris. "Electronic Medical Records in the American Health System: Challenges and Lessons Learned." **Ciência & Saúde Coletiva** no. 4 (April) 25, 2020: 1293–1304. https://doi.org/10.1590/1413-81232020254.28922019.

Kish Leslie Survey Sampling 1965. New York: John Wiley and Sons, inc.

"Nigerian Documents: National Health ICT Strategic Framework| Nigeria." n.d. Nigerian Documents 2016. https://nigeriandocuments.blogspot.com/p/main-document-national-health-ict.html.

Nøhr, C. 2006. "Evaluation of Electronic Health Record Systems." **Year book of Medical Informatics** 15, no. 01 (August): 107–13. https://doi.org/10.1055/s-0038-1638481.

Reuters. "Moves-Silverfleet Capital, State Street Global Advisors, Mashreq," April 3, 2017, sec. Financials. https://www.reuters.com/article/financial-moves-idINL3N1HB39U.

Sittig, Dean F. 2011. "Defining Health Information Technology–Related Errors." *Archives of Internal Medicine* 171, no. 14 (July) 2013; 1281. https://doi.org/10.1001/archinternmed.2011.327.

Journals

Abu-elezz, Israa, Asma Hassan, Anjanarani Nazeemudeen, Mowafa Househ, and Alaa Abd-alrazaq. "The Benefits and Threats of Blockchain Technology in Healthcare: A Scoping Review." **International Journal of Medical Informatics** 142, no. October 2020. (104246). https://doi.org/10.1016/j.ijmedinf.2020.104246.

Adeleke, Ibrahim Taiwo, Adedeji Hakeem Lawal, Razzaq Adetona Adio, and AbdulLateef Adisa Adebisi. "Information Technology Skills and Training Needs of Health Information Management Professionals in Nigeria: A Nationwide Study." **Health Information Management Journal** 44, no. 1 (March) 2020. 30–38. https://doi.org/10.1177/183335831504400104.

Adeleke, Ibrahim Taiwo, Adedeji Hakeem Lawal, Razzaq Adetona Adio, and AbdulLateef Adisa Adebisi. "Information Technology Skills and Training Needs of Health Information Management Professionals in Nigeria: A Nationwide Study." **Health Information Management Journal** 44, no. 1 (March): 2015. 30–38. https://doi.org/10.1177/183335831504400104.

Adhikari, Nirajan, Joseph Mwesige, and Lester Kirchner. "Improving Value (Low Cost, Optimal Clinical Outcome, Patient Satisfaction) in a Skilled Nursing Facility: A Quality Improvement (QI) Project." **Advances in Clinical Medical Research and Healthcare Delivery** 1, no. 3 (November) 2021. https://doi.org/10.53785/2769-2779.1023.

Ahn, Dong-Gyu.. "Investigation of Applicability of Additive Manufacturing Processes to Appropriate Technologies for Developing Countries." *Academic Society for Appropriate Technology* 7, no. 2 (November) 2021 188–95. https://doi.org/10.37675/jat.2021.7.2.188.

Akinyemi, Oluwaseun Oladapo, Oluwafemi Akinyele Popoola, Adeola Fowotade, Olukemi Adekanmbi, Eniola O. Cadmus, and Adebusola Adebayo. 2021. "Qualitative Exploration of Health System Response to COVID-19 Pandemic Applying the WHO Health Systems Framework: Case Study of a Nigerian State." **Scientific African** 13, no. September (September): e00945. https://doi.org/10.1016/j.sciaf.2021.e00945.

Alotaibi, Yasser, and Frank Federico. "The Impact of Health Information Technology on Patient Safety." **Saudi Medical Journal** 38, no. 12 (December) 2018: 1173–80. https://doi.org/10.15537/smj.2017.12.20631.

Al-Shorbaji, Najeeb. "Improving Healthcare Access through Digital Health: The Use of Information and Communication Technologies." **Healthcare Access**, February - 2022.https://doi.org/10.5772/intechopen.99607.

Amlung, Joseph, Hannah Huth, Theresa Cullen, and Thomas Sequist. "Modernizing Health Information Technology: Lessons from Healthcare Delivery Systems." **JAMIA Open** 3, no. 3 (October) 2020.: 369–77. https://doi.org/10.1093/jamiaopen/ooaa027.

Arendt, Lukasz. “Barriers to ICT Adoption in SMEs: How to Bridge the Digital Divide?” **Journal of Systems and Information Technology** 10, no. 2 (August) 2008; 93–108. https://doi.org/10.1108/13287260810897738.

Asangansi, Ime.. “Understanding HMIS Implementation in a Developing Country Ministry of Health Context - an Institutional Logics Perspective.” **Online Journal of Public Health Informatics** 4, no. 3 (December) 2012. https://doi.org/10.5210/ojphi.v4i3.4302.

Bello, I. S., Arogundade, F. A., Sanusi, A. A., Ezeoma, I. T., Abioye-Kuteyi, E. A., & Akinsola, A. (2004). Knowledge and utilization of Information Technology among health care professionals and students in Ile-Ife, Nigeria: a case study of a university teaching hospital. *Journal of medical Internet research*, *6*(4), e45. https://doi.org/10.2196/jmir.6.4.e45

BeLue, Rhonda, Lorinette Wirth, Amanda Steormer, and Suzanne Alexander. “The Community Analytics Academy Pilot: A Community-Academic Partnership for Building Community Health Care Analytic Capacity.” **Journal of Primary Care & Community Health** 11, no. (January) 2020; 215013272093240. https://doi.org/10.1177/2150132720932408.

Burney, Dr S M Aqil, Nadeem Mahmood, and Zain Abbas. “Information and Communication Technology in Healthcare Management Systems: Prospects for Developing Countries.” **International Journal of Computer Applications** 4, no. 2 (July) 2010; 27–32. https://doi.org/10.5120/801-1138.

Baron, Richard J. “Meaningful Use of Health Information Technology Is Managing Information.” *JAMA* 304, no. 1 (July): 2010. 89. https://doi.org/10.1001/jama.2010.910.

Bernstein, Knut, Morten Bruun-Rasmussen, Søren Vingtoft, Stig Kjær Andersen, and Christian Nøhr.. “Modelling and Implementing Electronic Health Records in Denmark.” **International Journal of Medical Informatics** 74, no. 2-4 (March) 2018; 213–20. https://doi.org/10.1016/j.ijmedinf.2004.07.007.

Buntin, Melinda Beeuwkes, Matthew F. Burke, Michael C. Hoaglin, and David Blumenthal. 2011. "The Benefits of Health Information Technology: A Review of the Recent Literature Shows Predominantly Positive Results." *Health Affairs* 30, no. 3 (March): 464–71. https://doi.org/10.1377/hlthaff.2011.0178.

Cresswell, K. M., D. W. Bates, and A. Sheikh. "Ten Key Considerations for the Successful Implementation and Adoption of Large-Scale Health Information Technology." **Journal of the American Medical Informatics Association** 20, no. e1 (June): 2013. e9–13. https://doi.org/10.1136/amiajnl-2013-001684.

Edwards-Schachter, Mónica. "The Nature and Variety of Innovation." *International* **Journal of Innovation Studies** 2, no. 2 (June): 2018. 65–79. https://doi.org/10.1016/j.ijis.2018.08.004.

Ehrenreich, Katherine, and Katrina Kimport. "Prenatal Care as a Gateway to Other Health Care: A Qualitative Study." **Women's Health Issues**, (October) 2022. https://doi.org/10.1016/j.whi.2022.08.006.

Gabriel Alobo, Igbo, Tolulope Soyannwo, Godwin Ukponwan, Simon Akogu, Abubakar Matthew Akpa, and Kazeem Ayankola. "Implementing Electronic Health System in Nigeria: Perspective Assessment in a Specialist Hospital." **African Health Sciences** 20, no. 2 (July) 2020: 948–54. https://doi.org/10.4314/ahs.v20i2.50.

Goldschmidt, Peter G. 2005. "HIT and MIS." **Communications of the ACM** 48, no. 10 (October): 68. https://doi.org/10.1145/1089107.1089141.

Goodman, Brian D., and Ran S. H. Zhou. "Bridging to the Cloud: Solution Design Trends Helping 'Legacy' Systems Leverage Cloud Computing." *2010 13th IEEE International Conference on Computational Science and Engineering*, December 2010. https://doi.org/10.1109/cse.2010.62.

Guo, Cui. "Theoretical Analysis of the Impact of Technological Innovation and Social Responsibility on Financial Performance." **Journal of Innovation and Social Science Research** no. 8 (August): 2021. 138–40. https://doi.org/10.53469/jissr.2021.08(08).27.

Hamann, Darla J, and Karabi C Bezboruah. "Outcomes of Health Information Technology Utilization in Nursing Homes: Do Implementation Processes Matter?" **Health Informatics Journal,** (January) 2020; 146045821989955. https://doi.org/10.1177/1460458219899556.

Hansen, Sean, and A. James Baroody. "Electronic Health Records and the Logics of Care: Complementarity and Conflict in the U.S. Healthcare System." *Information Systems Research* 31, no. 1 (March) 2020: 57–75. https://doi.org/10.1287/isre.2019.0875.

Hayrinen, K. K. Saranto, and P Nykanen. "Definition, Structure, Content, Use and Impacts of Electronic Health Records: A Review of the Research Literature." **International Journal of Medical Informatics** 77, no. 5 (May): 2008. 291–304. https://doi.org/10.1016/j.ijmedinf.2007.09.001

Huryk, Laurie A. "Factors Influencing Nurses' Attitudes towards Healthcare Information Technology." **Journal of Nursing Management** 18, no. 5 (July) 2010; 606–12. https://doi.org/10.1111/j.1365-2834.2010.01084.x.

Haaga, John, Kathleen O'Connor, Maxine Weinstein, and Phyllis Wise. "Reproductive Aging: Theoretical Perspectives, Mechanisms, Nonhuman Models, and Health Correlates." **Annals of the New York Academy of Sciences** 1204, no. 1 (August): 2010. 1–10. https://doi.org/10.1111/j.1749-6632.2010.05700.x.

Herbet, Irénée, and Jérôme Drevon. n.d. "Engaging Armed Groups at the International Committee of the Red Cross: Challenges, Opportunities and COVID-19." *International Review of the Red Cross*, 1–11. Accessed December 2, 2021. https://doi.org/10.1017/S1816383121000588.

Housego, Anthony, and Terry O'Brien. "Delivery of Public Services by Non-Government Organisations 1." **Australian Journal of Public Administration** 71, no. 2 (June) 2012; 211–20. https://doi.org/10.1111/j.1467-8500.2012.00765.x.

Huvila, Isto, Annemaree Lloyd, John M. Budd, Carole Palmer, and Elaine Toms. "Information Work in Information Science Research and Practice." **Proceedings of**

the Association for Information Science and Technology 53, 2016. no. 1: 1–5. https://doi.org/10.1002/pra2.2016.14505301004.

Ibarra-Barrueta, Olatz, Eguzkiñe Ibarra-García, and Estibaliz Pérez-Díez. "Implementation of a Pharmacy E-Inter-consultation Integrated in Patient Medical Record." **European Journal of Hospital Pharmacy** 28, no. e1 (November) 2020. e124–27. https://doi.org/10.1136/ejhpharm-2020-002224

Islam, Nazrul. "The Use of Information and Communication Technology (ICT) and Business Management: Contemporary Issues and Challenges." *SSRN* **Electronic Journal.** 2016. https://doi.org/10.2139/ssrn.2856262.

Jones, Peter, Tom Hughes, and Tom Morton.. "Information Technology Coding Systems in the Emergency Department: It Is Not the Tools, It Is How We Use Them." *Emergency Medicine Australasia* 31, no. 5 (September) 2019; 700–701. https://doi.org/10.1111/1742-6723.13378.

Kanwal, Shadaab, Marty Kohn, and Neil W Treister. "Population Health Management: A Roadmap for Provider-Based Automation in a New Era of Healthcare."http://c4fd63cb482ce6861463-bc6183f1c18e748a49b87a25911a0555.r93.cf2.rackcdn.com/iHT2_BigData_2013.pdf.

Kamau, Nancy, and Symphrose Ouma.. "The Impact of E-Resources on the Provision of Health and Medical Information Services in Kenya." **Journal of Electronic Resources in Medical Libraries** 5, no. 2 (June) 2018; 133–47. https://doi.org/10.1080/15424060802064329.

Kaplan, Bonnie. "Revisiting Health Information Technology Ethical, Legal, and Social Issues and Evaluation: Telehealth/Telemedicine and COVID-19." **International Journal of Medical Informatics** 143, no. July 2020. 104239. https://doi.org/10.1016/j.ijmedinf.2020.104239.

Keskinbora, Kadircan, and Fatih Güven.. "Artificial Intelligence and Ophthalmology." **Turkish Journal of Ophthalmology** 50, no. 1 (January) 2020; 37–43. https://doi.org/10.4274/tjo.galenos.2020.78989.

Khan, Sana Z., Zahraa Shahid, Karin Hedstrom, and Annika Andersson. "Hopes and Fears in Implementation of Electronic Health Records in Bangladesh." **The Electronic Journal of Information Systems in Developing Countries** 54, no. 1 (October) 2012; 1–18. https://doi.org/10.1002/j.1681-4835.2012.tb00387.x.

Klisowska, Iwona, Mariola Seń, Agnieszka Lintowska, Jadwiga Staniszewska, and Andrzej Staniszewski. "Information Technology and Its Benefits in Nursing Care of the Patient." *E-Methodology* 5, no. 5 (April) 2019; 24–30. https://doi.org/10.15503/emet.v5i5.523.

"La Historia Clínica Electrónica En Pediatría: Funcionalidades Y Buenas Prácticas de Uso.". *Archivos Argentinos de Pediatria* 119, no. 6 (December) 2021.https://doi.org/10.5546/aap.2021.s236.

"Language, Structure, and Reuse in the Electronic Health Record.". **AMA Journal of Ethics** 19, no. 3 (March) 2017; 281–88. https://doi.org/10.1001/journalofethics.2017.19.3.stas1-1703.

Lee, KH, YK Kim, SO Hwang, and H Kim. "Effect of Telemedicine for a Pre-hospital Suburban Emergency Medical Service." **Critical Care** 12, no. Suppl 2 2018: P341. https://doi.org/10.1186/cc6562.

Lee, Seonah, and Ji-Soon Kang. "Unintended Consequences and Workarounds of Electronic Medical Record Implementation in Clinical Nursing Practice." **CIN: Computers, Informatics, Nursing** Publish Ahead of Print, no. (June) 2021.https://doi.org/10.1097/cin.0000000000000785.

Lee, Seonheui, and Soyoung Yu. "Effectiveness of Information and Communication Technology (ICT) Interventions in Elderly's Sleep Disturbances: A Systematic Review and Meta-Analysis." **Sensors** 21, no. 18 (January): 2021. 6003. https://doi.org/10.3390/s21186003.

Liang, Su-Ying, Laura Eaton, Sukyung Chung, and Harold Luft. "Impact of Physician Practice Style on Costs, Clinical Quality, Patient Experience, Physician Productivity, and Physician Time." **Journal of Patient-Centered Research and Reviews** 4, no. 3 (August): 2017. 153–54. https://doi.org/10.17294/2330-0698.1480.

Lin, Cheryl, Wendy E. Braund, John Auerbach, Jih-Haw Chou, Ju-Hsiu Teng, Pikuei Tu, and Jewel Mullen. "Policy Decisions and Use of Information Technology to Fight 2019 Novel Coronavirus Disease, Taiwan." *Emerging Infectious Diseases* 26, no. 7 (July) 2020. https://doi.org/10.3201/eid2607.200574.

Lurio, J., F. P. Morrison, M. Pichardo, R. Berg, M. D. Buck, W. Wu, K. Kitson, F. Mostashari, and N. Calman. "Using Electronic Health Record Alerts to Provide Public Health Situational Awareness to Clinicians." **Journal of the American Medical Informatics Association** 17, no. 2 (February): 2010. 217–19. https://doi.org/10.1136/jamia.2009.000539.

M, Athar.. "Truth About: Coronavirus (COVID19)." **Open Access Journal of Pulmonary & Respiratory Sciences** 5, no. S12020. https://doi.org/10.23880/oajprs-16000s1-002.

Manrique, J. M., and L. R. Jones. "Genetic Data Generated from Virus–Host Complexes Obtained by Membrane Co-Immobilization Are Equivalent to Data Obtained from Tangential Filtrate Virus Concentrates and Virus Cultures." *Virus Genes* 48, no. 1 (October) 2013: 160–67. https://doi.org/10.1007/s11262-013-0999-7.

Makeham, Meredith. "Role of Digital Technology in Delivering 'Healthy Futures' and 'Healthy Cities." **Internal Medicine Journal** 50, no. 11 (November): 2020. 1408–9. https://doi.org/10.1111/imj.15062.

Mekhjian, H. S., R. R. Kumar, L. Kuehn, T. D. Bentley, P. Teater, A. Thomas, B. Payne, and A. Ahmad. "Immediate Benefits Realized Following Implementation of Physician Order Entry at an Academic Medical Center." **Journal of the American Medical Informatics Association** 9, no. 5 (September): 2012. 529–39. https://doi.org/10.1197/jamia.m1038.

Menachemi, Nir, and Taleah Collum. "Benefits and Drawbacks of Electronic Health Record Systems." **Risk Management and Healthcare Policy** 4, no. 4 (May): 2011. 47–55. https://doi.org/10.2147/rmhp.s12985.

Noblin, Alice, Barbara Hewitt, Murad Moqbel, Scott Sittig, Lakesha Kinnerson, and Vera Rulon. "Can Caregivers Trust Information Technology in the Care of Their Patients? A Systematic Review**." Informatics for Health and Social Care** 46, no. 1 (December) 2020; 29–41. https://doi.org/10.1080/17538157.2020.1834399.

Ogaji, Daprim, and Chinelo Ezinwanne Anyanwu. "Implementing Electronic Health Care Record in a Public Health Facility in Nigeria: Awareness, Acceptance and Concerns among Critical Stakeholders." **International Journal of Electronic Health care** 11, 2021.no. 1: 1. https://doi.org/10.1504/ijeh.2021.10039629.

Ojo, Adebowale I., and Sunday O. Popoola. "Some Correlates of Electronic Health Information Management System Success in Nigerian Teaching Hospitals." **Biomedical Informatics Insights** 7, no. January 2019: BII.S20229. https://doi.org/10.4137/bii.s20229.

Ojo, Adebowale Ifeoluwa. "Repositioning Health Information Management Practice in Nigeria: Suggestions for Africa." **Health Information Management Journal** 47, no. 3 (October) 2017: 140–44. https://doi.org/10.1177/1833358317732008.

Omole, Segun Michael, Adebayo b, Tajudeen Temitayo, Ogunniran c, Adebayo Olawepo, Amin a, Muyiwa Adekunle, Adio b, and Rasaq Adetona. "Influence of Health Records Management Practice On Disease Surveillance And Notification System In Atakunmosa West Local Government Area, Osun State, Nigeria." **International Journal of Advanced Research** 7, no. 1 (January): 2019. 579–89. https://doi.org/10.21474/ijar01/8365.

Opeyemi D, Soyemi. "Information and Communication Technology (ICT) Skill and Quality Medical Care in Federal Medical Centre, Owo, Ondo State, Nigeria." **International Journal of Multidisciplinary Research and Analysis** 05, no. 02 (February). 2022. https://doi.org/10.47191/ijmra/v5-i2-15.

Pai, Manohara M. M., Raghavendra Ganiga, Radhika M. Pai, and Rajesh Kumar Sinha. "Standard Electronic Health Record (EHR) Framework for Indian Healthcare System." **Health Services and Outcomes Research Methodology**, January (January) 2021.https://doi.org/10.1007/s10742-020-00238-0.

Phelan, Matthew, Nrupen Bhavsar, and Benjamin A Goldstein. "Illustrating Informed Presence Bias in Electronic Health Records Data: How Patient Interactions with a Health System Can Impact Inference." *EGEMs (Generating Evidence & Methods to Improve Patient Outcomes)* 5, no. 1 (December): 2017. 22. https://doi.org/10.5334/egems.243.

Raghupathi, Wullianallur, and Viju Raghupathi. "Big Data Analytics in Healthcare: Promise and Potential." *Health Information Science and Systems* 2, no. 1 (February). 2014. https://doi.org/10.1186/2047-2501-2-3.

Ramdas, Kamalini, Ara Darzi, and Sanjay Jain. "'Test, Re-Test, Re-Test': Using Inaccurate Tests to Greatly Increase the Accuracy of COVID-19 Testing." **Nature Medicine** 26, no. 6 (May) 2020 ; 810–11. https://doi.org/10.1038/s41591-020-0891-7.

Safety, Institute of Medicine (US) Committee on Data Standards for Patient. 2003. *Key Capabilities of an Electronic Health Record System Letter Report*. *Www.ncbi.nlm.nih.gov*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK221800/.

Scalvini, Simonetta, Doriana Baratti, Giuliano Assoni, Margherita Zanardini, Laura Comini, and Palmira Bernocchi.. "Information and Communication Technology in Chronic Diseases: A Patient's Opportunity." **Journal of Medicine and the Person** 12, no. 3 (July) 2013; 91–95. https://doi.org/10.1007/s12682-013-0154-1.

Scott-Emuakpor, Ajovi.. "The Evolution of Health Care Systems in Nigeria: Which Way Forward in the Twenty-First Century." **Nigerian Medical Journal** 51, no. 2 (April) 2010; 53. http://www.nigeriamedj.com/text.asp?2010/51/2/53/70997.

Shaikh, Mohsin, Arshad HM Vayani, Sabina Akram, and Nafees Qamar. "Open-Source Electronic Health Record Systems: A Systematic Review of Most Recent Advances." **Health Informatics Journal** 28, no. 2 (January): 2022. 146045822210998. https://doi.org/10.1177/14604582221099828.

Smagulov, Serik, and Viktoriya Smagulova.. "Digital Transformation of Healthcare." *Intellectual Archive* 8, no. 1 (SI) (March) 2019.https://doi.org/10.32370/ia_2019_01_si_1.

Somadatta Karanjekar *et al.* "Building QFD Model for Technical Education, Students as Stakeholders." **International Journal of Mechanical and Production Engineering Research and Development** 8, no. 1: 621–34. https://doi.org/10.24247/ijmperdfeb201869. 2018.

Stansfield, Mark**. International Journal of Information Management** 25, no. 3 (June): 282–83 2018. https://doi.org/10.1016/j.ijinfomgt.2005.02.004.

Sternitzke, Christian. "The International Preliminary Examination of Patent Applications Filed under the Patent Cooperation Treaty — a Proxy for Patent Value?" **Scientometrics** 78, no. 2 (October) 2008; 189–202. https://doi.org/10.1007/s11192-007-1837-x.

Subrahmanya, Sri Venkat Gunturi, Dasharathraj K. Shetty, Vathsala Patil, B. M. Zeeshan Hameed, Rahul Paul, Komal Smriti, Nithesh Naik, and Bhaskar K. Somani. "The Role of Data Science in Healthcare Advancements: Applications, Benefits, and Future Prospects." **Irish Journal of Medical Science** 2021. August https://doi.org/10.1007/s11845-021-02730-z.

Taiwo Adeleke, Ibrahim. "Health Information Technology in Nigeria: Stakeholders' Perspectives of Nationwide Implementations and Meaningful Use of the Emerging Technology in the Most Populous Black Nation." **American Journal of Health Research** 3, 2015. no. 1: 17. https://doi.org/10.11648/j.ajhr.s.2015030101.13.

Tan, M, B Keenan, B Staley, R Anafi, R Schwab, and S Schutte-Rodin. "1083 Using an Electronic Health Record (EHR) to Identify Chronic CPAP Users with Abnormal HL7

CPAP Data." *Sleep* 41, no. suppl_1 (April) 2018; A402–2. https://doi.org/10.1093/sleep/zsy061.1082.

Tang, Paul C., and David Lansky. "The Missing Link: Bridging the Patient–Provider Health Information Gap." **Health Affairs** 24, no. 5 (September) 2005: 1290–95. https://doi.org/10.1377/hlthaff.24.5.1290.

Teklewold, Berhanetsehay, Goytom Knfe, and Firaol Dandena.. "Improving Completeness of Surgical Inpatient Medical Records in Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia." **Hospital Topics**, (November) 20211–7. https://doi.org/10.1080/00185868.2021.2005500.

"The Research Foundation of Hospital and Healthcare Administration.". **International Journal of Research Foundation of Hospital and Healthcare Administration** 2, no. 1: 66–67 2014. https://doi.org/10.5005/jrfhha-2-1-66.

Thouin, Mark F., James J. Hoffman, and Eric W. Ford. "The Effect of Information Technology Investment on Firm-Level Performance in the Health Care Industry." **Health Care Management Review** 33, no. 1 (January): 2008. 60–68. https://doi.org/10.1097/01.hmr.0000304491.03147.06.

Turan, Aykut H, and Tuğba Koç. "Health Information Technology Adoption and Acceptance of Turkish Physicians-A Model Proposal and Empirical Assessment." **Health Informatics Journal** 28, no. 2 (January) 2022:146045822210960. https://doi.org/10.1177/14604582221096041.

Ueckert, Frank, Michael Goerz, Maximilian Ataian, Sven Tessmann, and Hans-Ulrich Prokosch. "Empowerment of Patients and Communication with Health Care Professionals through an Electronic Health Record." **International Journal of Medical Informatics** 70, no. 2-3 (July): 2003. 99–108. https://doi.org/10.1016/s1386-5056(03)00052-2.

Wang, Xiaoli, Zhiyong Zhang, Jun Zhao, and Yongqiang Shi. "Impact of Telemedicine on Healthcare Service System Considering Patients' Choice." **Discrete Dynamics in Nature and Society** 2019, no. February: 1–16. https://doi.org/10.1155/2019/7642176.

Williams, F. A. Oke, and I. Zachary. “Public Health Delivery in the Information Age: The Role of Informatics and Technology.” **Perspectives in Public Health** 139, no. 5 (February) 2019: 236–54. https://doi.org/10.1177/1757913918802308.

Winter, Alfred, Sebastian Stäubert, Danny Ammon, Stephan Aiche, Oya Beyan, Verena Bischoff, Philipp Daumke, *et al.* “Smart Medical Information Technology for Healthcare (SMITH).” *Methods of Information in Medicine* 57, no. S 01 (July) 2018;.e92–105. https://doi.org/10.3414/ME18-02-0004

Yaya-Beas, Rosa-Elena, Christian Ayala-Limaylla, Katarzyna Kujawa-Roeleveld, Jules van Lier, and Grietje Zeeman. “Yaya-Beas, R.-E., *et al.* Helminth Egg Removal Capacity of UASB Reactors under Subtropical Conditions. Water 2015, 7, 2402–2421.” *Water* 7, no. 9 (September): 2015. 5152–54. https://doi.org/10.3390/w7095152.

YIN, Yuehong, Yan Zeng, Xing Chen, and Yuanjie Fan. “The Internet of Things in Healthcare: An Overview.” **Journal of Industrial Information Integration** 1, no. March 2016. 3–13. https://doi.org/10.1016/j.jii.2016.03.004.

Publications

“AbouZahr, Carla, and Ties Boerma. “Health Information Systems: The Foundations of Public Health.” **Bulletin of the World Health Organization** 83, no. 8 (August) 2005; 578–83. https://apps.who.int/iris/handle/10665/269465.

“College Quarterly - Articles - an Exploration of the Use of Information and Communication Technologies in the College Classroom.” n.d. Collegequarterly.ca. http://collegequarterly.ca/2003-vol06-num01-fall/lopes.html.

Directorate-General for Health and Food Safety (European Commission), Gesundheit Österreich Forschungs- und Planungs GmbH, Sogeti, Julia Bobek, Anna-Theresa Renner, Anja Laschkolnig, and Claudia Habl. **Study on Big Data in Public Health, Telemedicine and Healthcare: Executive Summary. Publications Office of the European Union.** LU: Publications Office of the European Union. 2016.

https://op.europa.eu/en/publication-detail/-/publication/5db46b33-c67f-11e6-a6db-01aa75ed71a1/language-en.

Haskew, C, P Spiegel, B Tomczyk, N Cornier, and Hering. "A Standardized Health Information System for Refugee Settings: Rationale, Challenges and the Way Forward." **Bulletin of the World Health Organization** 88, no. 10 (October) 2010; 792–94. https://doi.org/10.2471/blt.09.074096.

Martin, John. 2009. "Global Institutions: The World Health Organization (WHO)." **Bulletin of the World Health Organization** 87, no. 6 (June): 484–84. https://doi.org/10.2471/blt.08.060814.

Report

Mitchell, John T., Alex Bates, and Lidia Zylowska. 2018. "Adverse Events in Mindfulness-Based Interventions for ADHD." **The ADHD Report** 26, no. 2 (February): 15–18. https://doi.org/10.1521/adhd.2018.26.2.15.

Safety, Institute of Medicine (US) Committee on Data Standards for Patient. 2003. *Key Capabilities of an Electronic Health Record System Letter Report*. *Www.ncbi.nlm.nih.gov*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK221800/.

Weingarten, S. R. 2012. "Interventions Used in Disease Management Programmes for Patients with Chronic Illness---Which Ones Work? Meta-Analysis of Published Reports." *BMJ* 325, no. 7370 (October): 925–25. https://doi.org/10.1136/bmj.325.7370.925.

Website

Lok, Corie. 2021. "Picture Perfect." *Nature* 412, no. 6845 (July): 372–74. https://doi.org/10.1038/35086702.

Srmunera. 2018. "Use of Wearables Devices in the Health Sector." Dy Care. May 3, 2018. https://www.dycare.com/divulgation/use-of-wearables-devices-in-the-health-sector/.

World Health Organization. 2022. “Home.” Who.int. 2022. https://www.who.int.

“Trends in Information Technology Project Management.” 2016. **Issues in Information Systems**. https://doi.org/10.48009/3_iis_2016_187-198.

Appendix I

Consent Form

Dear Interested Participant,

You are invited to take part in the research study titled **"**Assessment on the Application of Information Technology for Health Information Management Practice in University College Hospital (UCH), Ibadan" conducted by MPH. Student of Lead City University Ibadan Oyo State as one of the requirements for the award of master in Public Health. The purpose of the study is purely academic and highly confidential. Your participation is completely voluntary, you can withdraw or accept at any given time without any penalties being attached. Only health care workers using IT in discharge of their duties are eligible to participate.

Objectives

The objectives of this study will be to identify application areas of Information Technology for Health Information Management practice in the University College Hospital (UCH), Ibadan, to ascertain the availability of IT products in the key areas of HIM practice in UCH, Ibadan, to determine the staff's attitude towards IT application in HIM practices on health care delivery in UCH, Ibadan, and to identify the associated challenges with IT application in HIM practice in UCH, Ibadan

Benefit and Risk

There is no direct benefit to being a participant in this study, but the data collected from the participants will be analyzed and the result will be used to make policies in developing strategies for the transformation. There is no harm in being a participant in this study, you are free not to answer any questions that make you feel uncomfortable.

Whom to Contact

You are free to contact the principal investigator with any information needed.

Adedokun Sofiyat
Department of Public Health
Lead City University, Ibadan, Oyo State.
adedokunsoffiyah0409@gmail.com

Having read and understood this information I hereby affirmed (YES) or (NO) to participate in the study by signing this form below:

.....	.....
Date and Signature	Date and Signature
Consenting participant	Principal investigator

Thank you

Appendix II

Questionnaire

Department of Public Health

Faculty of Basic Medical and Applied Sciences

Lead City University, Ibadan, Nigeria.

I am a master student of the above-named institution, conducting a study on the assessment on the application of information technology (IT) for Health Information Management (HIM) in University College Hospital, Ibadan.

This questionnaire is designed to collect information on the above topic among healthcare workers in the hospital for academic purposes only, and the researcher would be grateful if you could spare some minutes of your time to answer the questions below. All information provided will be treated confidential.

Note: Information technology (IT) *is the use of any computers (mobile devices), storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data.*

Section A: Socio-demographic Information (Please tick (√) as appropriate)

1. Section/Unit……
…..
2. Age as at last birthday (years) ……
3. Sex: Male () Female ()
4. Religion: (1) Christianity (b) Islam (3) Traditional (4) others ……
5. Cadre: (1) Doctors (2) Nurses (3) Medical lab Scientist (4) HIM (5) Physiotherapist (6) pharmacists (7) Radiographer (8) Clinical Psychologist (9) Community Health Officer (10) others.....
6. Highest Educational attainment: ND ( ) HND/BSC ( ) MSc/PH. D()
7. Length of service (years): ……..
8. Do you have a personal computer Yes ( ) No ( )
9. Do you have a mobile tablet Yes ( ) No ( )
10. Which of these general-purpose software's do you use? Tick as appropriate

Microsoft Word	[ ]
Microsoft Access	[ ]
Microsoft Excel	[ ]
Microsoft PowerPoint	[ ]
Statistical Package for Social Sciences (SPSS)	[ ]

Section B: Attitude towards IT application in health care delivery

Kindly signify by ticking appropriately.

S/N	ITEMS	YES	NO	I DON'T KNOW
11.	I think application of IT in HIM improves quality of care			
12.	I believe that application of IT would result to retrenchment of HIM personnel?			
13.	The quality of data for clinical decision making is improved when IT products are implemented in HIM			
14.	Application of IT in HIM reduces medical errors			
15.	Is it important to apply IT and its product in delivery healthcare services			
16.	Application of IT innovations and products is a difficult task that comes with many challenges			
17.	I think the use of IT in HIM makes life easier at work			
18.	Privacy of patients' information is compromised with application of IT			
19.	Application of IT products and innovations distorts the flow of work in my office			

20.	Application of IT products and innovations improves medical outcome			

Section D: Benefits of information technology application

Kindly tick as appropriate

S/N	ITEMS	YES	NO
21.	Application of information Technology e.g. electronic health records (EHR) improves the quality of my work in providing better services.		
22.	IT innovations can give me greater control over my work schedule.		
23.	Application of IT innovations allows me to accomplish tasks more quickly		
24.	IT allows me to accomplish more work than would otherwise be possible		
25.	IT helps to enhance my overall effectiveness in my job		
26.	Application of IT increases patient convenience		
27.	Application of IT helps to reduce waiting time		
28.	IT application reduces cost		
29.	Application of IT products improves access to healthcare service		
30.	Information Technology development allows multiple access to patients' information for healthcare service		
31.	IT enhances patients' data storage and retrieval		
32.	It increases the overall efficiency of health care delivery.		

Section E: Application of IT innovations and products

Kindly tick appropriately to show your level of agreement or disagreement

S/N	ITEMS	YES	NO
33.	Do you make use of IT ideas and products to store and manage patients' information?		
34.	Can IT products like computer or mobile devices be used to exchange official information with other professionals?		
35.	Do you use IT innovations to design forms for patients' data collection?		
36.	Can computer applications be used to perform clinical coding tasks?		
37.	Do you use statistical packages such as Microsoft excel, SPSS etc. to carry out data analysis task?		
38.	Do you make use of IT software to manage patients' appointment		
39.	IT is used to enhance record uniformity designed to reduce practice variations?		
40.	Do you use IT innovations to track and retrieve patient records?		
41.	Do you make use of IT skills to eliminate duplication of patients' records?		
42.	Do you apply IT skills to collect and analyze information relating to episode of inpatient treatment and bed utilization?		

Section C: Challenges of IT application

Kindly tick appropriately which of the following will you consider as challenges?

S/N	ITEMS	YES	NO
43.	Inadequate training		
44.	Inadequate IT facilities		
45.	Insufficient knowledge on the use of IT tools		

46.	Lack access to IT tools		
47.	Affordability		
48.	privacy issues		
49.	Security issues		
50.	Failure of equipment/ old IT tools		
51.	Old IT tools		
52.	Interoperability		
53.	Lack of management support		
54.	Changes in software		
55.	Changes in hardware		

Appendix III

Lead City University

Faculty of Public Health

Motto: Redefining Health

Ref: LCU/FPH/EXT/302 **Wednesday, August 17, 2022**

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION

I wish to inform you that the bearer is currently a Postgraduate student in the Faculty of Public Health, Lead City University, Ibadan.

The bearer is obliged to conduct research as one of the requirements for the award of a degree of Master in Public Health. In this regard, kindly accord any relevant information and assistance.

Thank you, and I look forward to your favorable support.

Best regards,

Dr. F. T. Akinsolu,
Head, Department of Public Health,
Lead City University, Ibadan.
Email: akinsolu.folahanmi@lcu.edu.ng
Contact Number: +2347033171050

Lagos-Ibadan Expressway, Toll Gate Area.
P.O. Box 30678, Secretariat, Ibadan Oyo State Nigeria.
publichealth@lcu.edu.ng
Tel: 02-7510682

Appendix IV

INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IAMRAT)
College of Medicine, University of Ibadan
Director: Prof. IkeOluwapo O. Ajayi,
MBBS (Ib), M. Cl.Sc., Ph.D, MD, FMCGP, FWACP
Tel: 08023268431
E-mail: ikeajayi2003@yahoo.com

UI/UCH EC Registration Number: **NHREC/05/01/2008a**

NOTICE OF FULL APPROVAL AFTER FULL COMMITTEE REVIEW

Re: Assessment on the application of Information Technology in health information practice in University Collage Hospital, Ibadan

UI/UCH Ethics Committee assigned number: UI/EC/22/0307
Name of Principal Investigator: **Sofiat Adedokun**
Address of Principal Investigator: Department of Public Health
Lead City University, Ibadan

Date of receipt of valid application: 19/08/2022

Date of meeting when final determination on ethical approval was made: **N/A**

This is to inform you that the research described in the submitted protocol, the consent forms, and other participant information materials have been reviewed and *given full approval by the UI/UCH Ethics Committee.*

This approval dates from **15/09/2022 to 14/09/2023.** If there is delay in starting the research, please inform the UI/UCH Ethics Committee so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. *All informed consent forms used in this study must carry the* UI/UCH EC *assigned number and duration of* UI/UCH EC *approval of the study.* It is expected that you submit your annual report as well as an annual request for the project renewal to the UI/UCH EC at least four weeks before the expiration of this approval in order to avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. *No changes are permitted in the research without prior approval by the* UI/UCH EC *except in circumstances outlined in the Code. The* UI/UCH EC *reserves the right to conduct compliance visit to your research site without previous notification.*

UI/UCH EC
13 SEP 2022
APPROVED
COLLEGE OF MEDICINE U.I.

Professor IkeOluwapo O. Ajayi
Director, IAMRAT
Chairperson, UI/UCH Research Ethics Committee
E-mail: uiuchec@gmail.com

Lead City University (LCU)

NHREC

Motto: Knowledge for Self-reliance

Lagos - Ibadan Expressway, Toll Gate Area, Ibadan, Oyo State, Nigeria
Email: lcu.hrec@lcu.edu.ng

University Research Ethics Committee

PROJECT TITTLE: **ASSESSMENT ON THE APPLICATION OF INFORMATION TECHNOLOGY FOR HEALTH INFORMATION MANAGEMENT IN UNIVERSITY COLLEGE HOSPITAL (UCH), IBADAN**

PROJECT NUMBER: **LCU-REC/22/149.**

APPROVAL LETTER

The above named proposal has been adequately reviewed; the protocol and safety guidelines satisfy the conditions of *LCU-REC* policies regarding experiments that use human subjects.

Therefore, the study under its reviewed state is hereby approved by the LCU - Research Ethics Committee.

Prof. Olusola Ladokun ..... *Name of LCU-REC Chairman* *Signature of LCU-REC Chairman*

Dr. Folahanmi Akinsolu ..... *Name of LCU-REC Secretary* *Signature of LCU-REC Secretary*

This approval is given with the investigator's Declaration as stated below;

By signing below I agree/certify that:

1. I have reviewed this protocol submission in its entirety and that I am fully cognizant of, and in agreement with all submitted statements.
2. I will conduct this research study in strict accordance with all submitted statements except where a change may be necessary to eliminate apparent immediate hazard to a given research subject.
   - I will notify the REC promptly of any change in research procedures necessitated in the interest of the safety of a given research subject.
   - I will request and obtain REC approval of any proposed modification to the research protocol or informed consent document(s) prior to implementing such modifications.

3. I will ensure that all co-investigator and other personnel assisting in the conduct of this research study have been provided a copy of the entire current version of the research protocol and are fully informed of the current (a) study procedures (including procedure modifications); (b) informed consent requirements and process; (c) potential risks associated with the study participation and the steps required to be taken to prevent or minimize these potential risks; (d) adverse events reporting requirements; (e) data and record-keeping; and (f) the current REC approval status of the research study.

4. I will respond promptly to all requests for information or materials solicited by the REC or REC Office.

5. I will submit the research study in a timely manner for the REC renewal approval.

6. I will not enroll any individual into this research study until such time I obtain his/her written informed consent, or if applicable, the written informed consent of his/her authorized representative (i.e unless the REC has granted a waiver of the requirement to obtain informed consent).

7. I will employ and oversee an informed consent process that ensures that potential research subjects understand fully the purpose of the research study, the nature of the research procedures they are being asked to undergo, the potential risks of these research procedures, and their rights as a research study volunteer.

8. I will ensure that the research subjects are kept fully informed of any new information that may affect their willingness to continue to participate in the research study.

9. I will maintain adequate, current, and accurate records of research data, outcomes, and adverse events to permit an ongoing assessment of the risks/benefits ratio of research study participation.

10. I am cognizant of, and will comply with, current federal regulations and REC requirements governing human subject research including adverse event reporting requirements.

11. I will make a reasonable effort to ensure that subjects who have suffered adverse event associated with research participation receive adequate care to correct or alleviate the consequences of the adverse event in the extent possible.

12. I will ensure that the conduct of this research study adheres to Good Clinical Practice guidelines.

Miss Adedokun Soffiyat .....

Principal Investigator's Name Principal Investigator's Signature and Date

Biodata

A. Personal data:

Full Name:	Adedokun Sofiyat
Address:	adedokunsoffiyah0409@gmail.com +2348153373885 Plot 54, Salawu Street, Old Ife-Road, Alakia, Ibadan
Date and Place of Birth:	4th September, 1993, Ibadan, Oyo State
Nationality:	Nigerian
Name and Address of Next of Kin:	Adedokun Muhammed-Ali Adedeji, +2348072305516

B. Educational Background:

School Attended	Date	Qualifications
• Christ Church School, Akinfenwa Ibadan, Oyo State	(1998-2003)	School Leaving Certificate
• Community Commercial High School	(2009)	SSCE
• University College Hospital (UCH)	(2010-2012)	National Diploma
• University College Hospital (UCH)	(2013-2015)	Higher National Diploma
• Adeleke University, Ede, Osun State	(2017-2019)	B.HIM
• Lead City University	(2020-Till Date)	M.Sc. in view

C. Awards and Fellowships (if any) None

D. Professional Membership: None

E. Publications (if any): None

_____ _____

Signature **Date**

University Compliance Certification

This is to certify that the thesis by **Adedokun Sofiyat** with Matric no LCU/PG/001838 in the department of **Public Health**, Faculty of Basic Medical and Health Sciences, Lead City University, is in full compliance with the approved university format and style.

_____ _____

Signature **Date**