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Research Article

Mobile Health Framework in Nigeria: A Proposal

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Abstract *- This paper attempts to propose a mHealth framework largely dependent on having a national electronic health record system that can be built upon to address manual record-keeping in various healthcare settings in Nigeria.*

Keywords *- Conceptual model, e-Healthcare, Find-A-Med, mHealth, Use-Case.*

1. Introduction

In this modern age, Information and Communication Technology (ICT) has contributed immensely to all parts of our lives, the way we interact and virtually all sectors of the human economy. The health sector across the globe is also not left out, as there has been a significant impact of ICTs. The adoption and use of ICT in health have led to "e-Healthcare", transforming how healthcare services are now being delivered [1].

Broadly ICT in health, referred to as e-health, includes the following- electronic health records are defined as the collection of patient's health records digitally in an electronic format; all records captured by the EHR systems are designed to be shared through a well-connected network across different platforms[2], the electronic medical record often used interchangeably with EHR but quite different can be defined as patient health record in an electronic format designed for members of staff within one health care organization [3].

Advancement in Information and Communication Technology (ICT) and the Internet has led to new technologies [4], such as Telemedicine which is the use of information and communication technologies by healthcare practitioners to exchange valid information for the diagnosis, treatment, and prevention of diseases and injuries, research and evaluation, and for the continuing education of healthcare providers to deliver health care services where distance is a major barrier [5]. Mobile Health, often referred to as mHealth, uses mobile and wireless technologies in deploying healthcare delivery and support wellness. It can further be defined as the practice of medicine via several mobile devices such as mobile phones, tablets, personal digital assistants and wearable devices [6].

2. Review of Related Works on E-Health

Numerous researchers have carried out investigations and improvements in Electronic Health. A few recent publications on this subject are discussed below – the study focused on the security of e-Health by establishing the nature of threats affecting the system and the review of implemented security safeguards. Findings established that when physical, logical and administrative controls are implemented with an EMR system, it improves the system's security. Unfortunately, the paper did not address the issues of security that may arise when all six (6) referral hospitals in Kenya are upgraded to become interoperable [7].

The article investigated the steps needed for EHR implementation, highlighting the challenges of working against it and the resources needed for EHR implementation [8]. The paper establishes that only a fully functional e-Health system can bridge the gap between Nigeria's poor health information system needed for monitoring and health indicator analysis [9]. “CarePlus”, an EMR software, was deployed for use in one hospital. It did not provide additional functionality to share clinical data in other health facilities [10].

A standardized and centralized NHMS record-keeping system that can share records dynamically online was proposed to address the Nigerian healthcare system's challenges. The limitation of this system is that it could only identify patients and their medical status, but their records could not be updated; also, more advanced security features needed to be added to restrict unauthorized users and malicious content [11].

The methodology approach in this research was based on a systematic literature review to identify likely resources to be set in motion by the Government, such as epileptic power supply, interoperability issues, poor orientation by the patients and healthcare practitioners, and poor internet connectivity should be addressed before the implementation of a national electronic health system [12].

The research analyses that the main barriers are militating against implementing the digital health record in Nigeria [13].

A cross-sectional explorative questionnaire was designed to evaluate the e-health practices in some hospitals in the Jigawa state in Nigeria. Findings from the study revealed that most hospitals (91.4% of respondents) still use traditional manual systems and electronic methods. Recommendations were made that the state government should invest massively in e-Health [14].

The study elucidated the robust potential of using electronic medical record systems to improve public health insurance schemes in sub-Saharan Africa in managing clinical data using Nigeria as a case study [15].

The key factors that will aid in implementing an integrated electronic health system were identified and summarized based on priority [16]. Barriers and facilitators to adopting electronic health implementation in low and middle-income countries were investigated [17].

Evaluation of EMR systems implemented in Sub-Saharan Africa using standardized metrics developed by the Healthcare Information and Management Systems Society (HIMSS) [18].

An electronic appointment system between patients and doctors in a private hospital in Kano State, Nigeria, was proposed and developed. The limitation of this work is that it is neither an EMR nor an EHR system but an automation of the appointment/booking system being used in the hospital. Security measures taken to safeguard patients' bio-data were not discussed [19].

Cross-sectional descriptive research was carried out to investigate patients' satisfaction after implementing an electronic medical record system with respect to pharmaceutical services in a tertiary hospital [20].

Mobile health (mHealth) was identified as an emerging technology with respect to its applications, benefits and challenges [6]. The paper was geared towards understanding privacy and security issues inherent in health record systems, thus leading to poor adoption of EMR systems in healthcare organizations [22].

Findings from the reviewed literature have shown that there is no national health record system in Nigeria. Most researchers focus on examining electronic health systems' impact, benefits, and challenges working against their adoption and evaluation, which are all descriptive research.

3. Current Health Processes and Mobile Health in Nigeria

Nigeria operates a Federal system of Government with three levels, namely federal, state and local government areas; there are 36 federation states with 774 LGAs. The 774 LGAs being closer to the people, have been constitutionally designed to be the primary healthcare providers, but unfortunately, it is the weakest arm of the sector [23]. Despite the huge sum of money allocated to the health sector annually by all the tiers of Government, the Nigeria health system has been in chaos due to the following reasons but not limited to physical infrastructure, supply systems, human resources availability and management, political interference and poor record-keeping etc.

Even the national health insurance scheme, despite its increasing popularity among the populace, seems to be unable to address the numerous challenges bedevilling the health sector, such as delayed registration and update, duplication of patient data, delay in delivery reports, and long waiting period in accessing health care services due to delay in clearance [24]. With such a program in place, one would have expected that there should be a central database system made available electronically to all participating stakeholders for effective decision-making and sharing of relevant data to appropriate policymakers for planning, but the reverse is the case.

The instances of some Mobile Health (mHealth) apps in the country, such as "Omomi", meaning "My Child", geared towards providing maternal information covering the health of a child and the mother aimed at reducing mortality, “myPaddi” an app developed towards addressing the stigma relating to sexual related issues, “Hudibia” caters for all sorts of medical problems known to an average Nigerian.

It was developed to accommodate all three indigenous languages in the country, "Find – A – Med", an app that helps Nigerians to find the nearest hospital closest to their locality [25]. Some of these mHealth apps may have led to increased awareness regarding health-related issues among internet-savvy citizens in the country.

Still, its significant improvement in the healthcare settings in the country remains debatable because they are mostly stand-alone apps without integration due to the unavailability of a national electronic health record system that can be harmonized together to become interoperable [21].

4. Proposed Mobile Health Framework

Clinic_ICT: A one mandatory-to-only-one-mandatory relationship. This implies that a clinic must have one ICT supporting staff managing its data and recording from time to time.

Clinic_Doctor: A one mandatory-to-one-or-many-mandatory relationship. A clinic can have as many doctors as possible.

Doctor_Patient: A one mandatory-to-one-or-many-mandatory relationship. A doctor could attend to as many patients as possible.

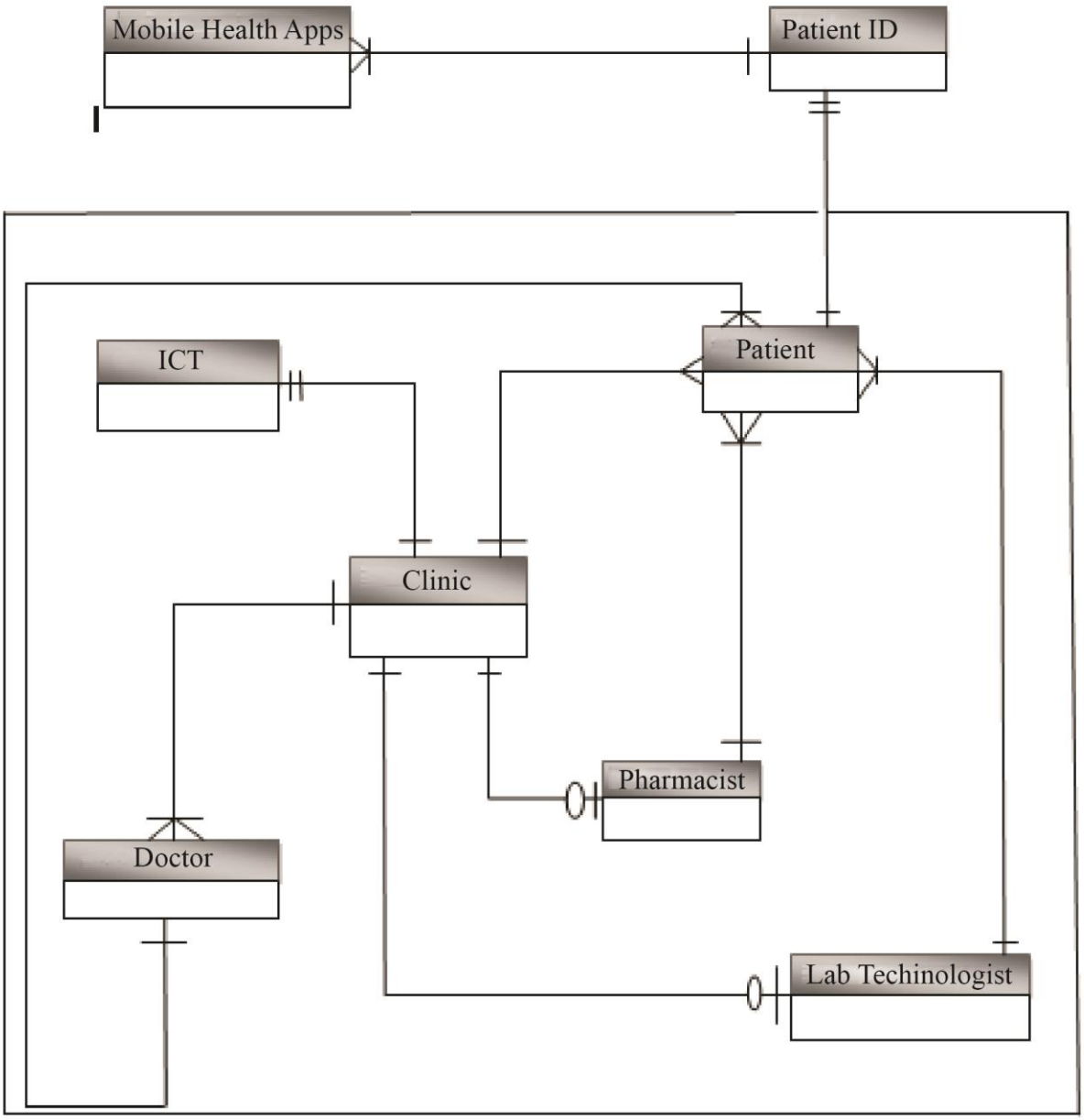

Fig. 1 Conceptual model for the mhealth framework

Patient_Patient ID: A one mandatory-to-only-one-mandatory relationship. A patient can only have one peculiar ID for identification on the national EHR system, which grants access to the patient's medical history.

Clinic_Patient: A one mandatory-to-many-mandatory relationship. A clinic can provide healthcare services to as many patients as possible.

Clinic_Pharmacist: A one mandatory-to-zero-or-one-mandatory relationship.

Clinic_Lab Technologist: A one mandatory-to-zero-or-one-mandatory relationship.

Pharmacist_Patient: A one mandatory-to-one-or-many-mandatory relationship.

Lab Technologist_Patent: A one mandatory-to-one-or-many-mandatory relationship.

PatientID_mHealthapps: A one mandatory-to-one-or-many mandatory relationship.

As long as a patient has a peculiar Id, such a patient can have access to so many mHealth apps that have been integrated into the national EHR system.

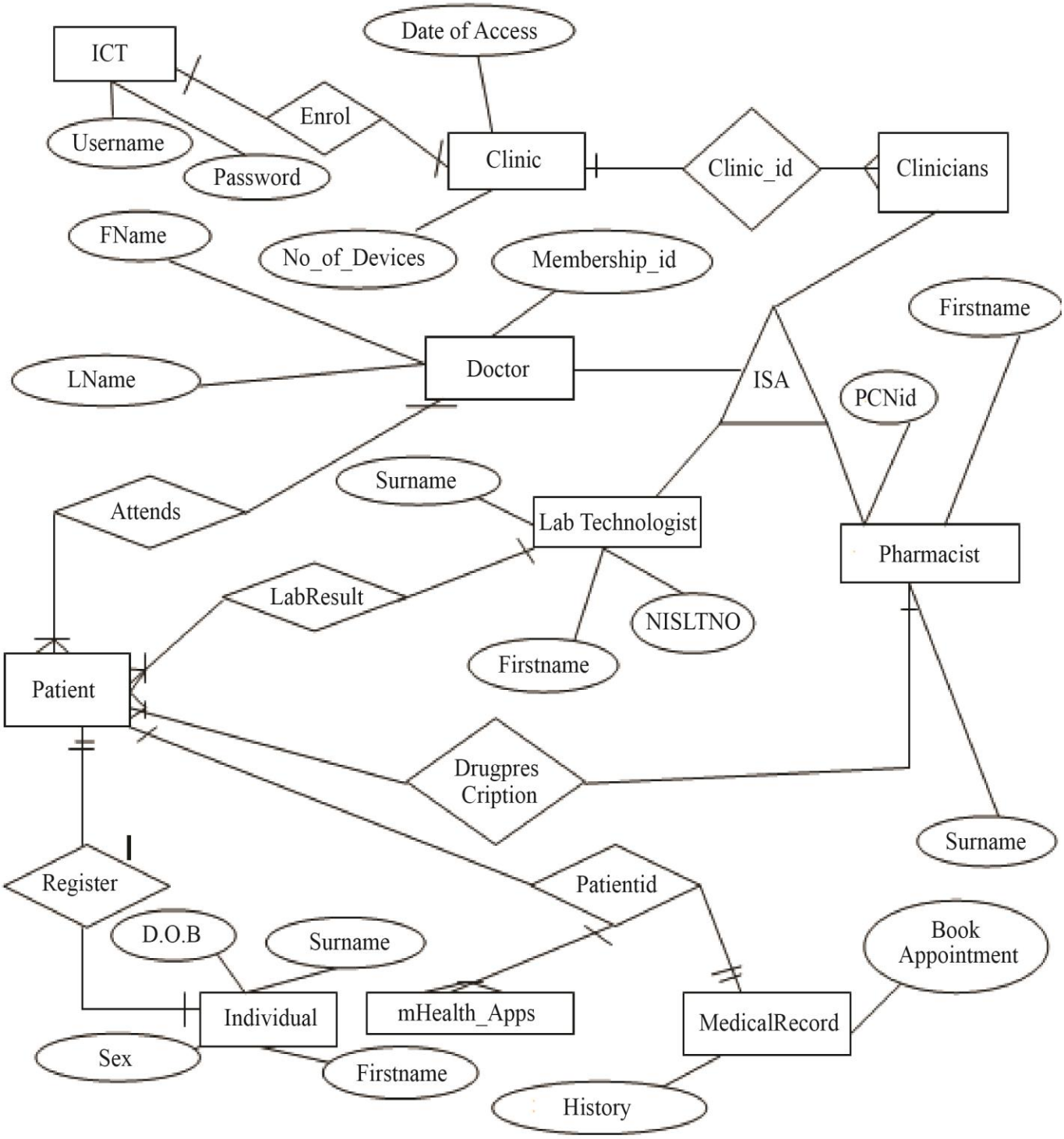

Fig. 2 Entity relationship diagram for the mhealth

Fig. 2 above describes the relationship between all the entities and their attributes for the mHealth Framework in the database.

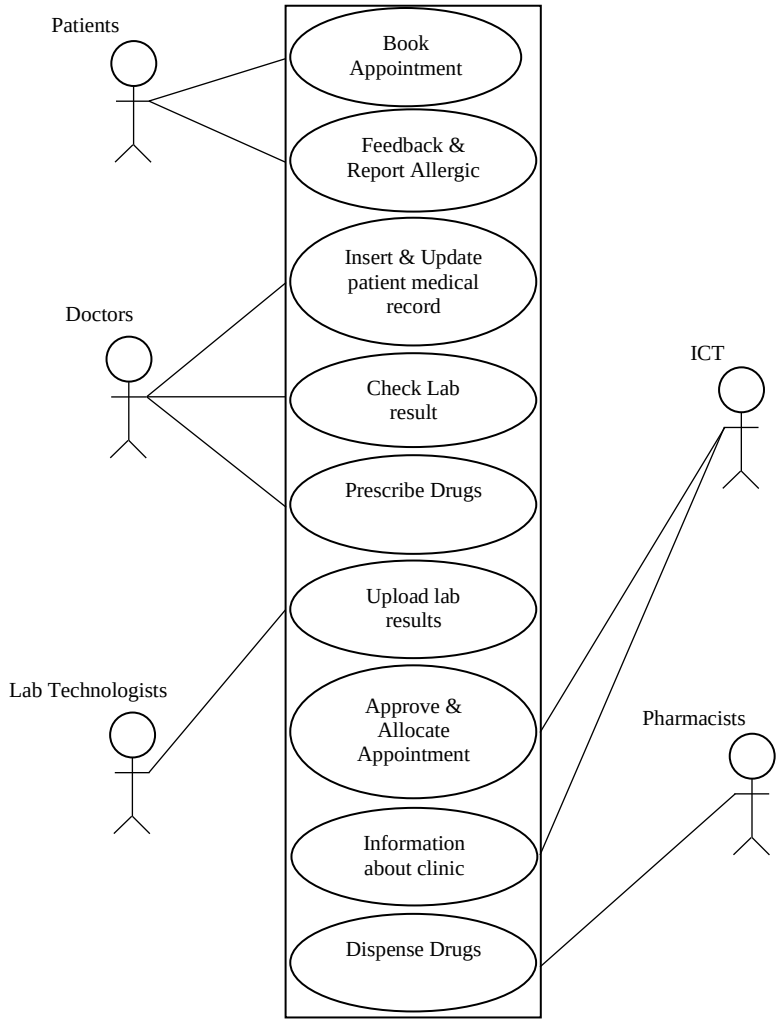

Fig. 3 Use-Case diagram for the mhealth framework

It is important to visualize the proposed architecture of the mobile health framework using a use case to determine the various stakeholders using the system. They include the patients, health care practitioners (Doctors, Pharmacists and lab technologists) and ICT.

The set of use cases in this research gives a clue on the Framework for the health system -

UC1 Authentication

UC1.1 Login

This describes the process of login into the mHealth system.

UC1.2 Patient login / Clinicians and ICT login through access code.

Patients are expected to login into the mHealth app using their Unique Identifier (PatientId) and password. At the same time, the health practitioners can only access the mHealth app after a private key (access code to identify the participating clinic and the device being used by the clinic on the mHealth app). This is necessary to safeguard and prevent clinicians' abuse of patient records.

UC1.3 Users log-out

These log-out users from the mHealth system.

UC2 Insert new patient record

This accepts the bio-data of the patient, such as name, sex, date of birth etc., into the database; once a new patient record has been inputted, a unique identifier (PatientId) is allocated to the patient, and it becomes one of the parameters to access the mHealth system.

UC3 Patient feedback or allergic to the drug

Patients can report being allergic to drugs or complain using their unique identifier.

UC4 Patient booking of appointment

Patients are allowed to book an appointment using their unique identifier.

UC5 Viewing of patient medical record
After logging into mHealth, doctors query the database with the unique patient identifier to check the patient's health record.

UC6 Check patient appointment status
Doctors query the mHealth database to determine who is on appointment for the day.

UC7 Checking of laboratory test results
This also helps doctors check the report of tests carried out on patients.

UC8 Drug prescription by doctors
Doctors can prescribe drugs to patients.

UC9 Uploading of Lab results
This allows laboratory technologists to upload the test results carried out on patients on the mHealth app.

UC10 Approve the patient appointment
It approves an appointment made by the patient for a particular day or reschedules it.

UC11 General Information about the hospital (available admission)
This displays any other information about the participating clinic, e.g. bed & room space available, Doctors on call etc.

UC12 Issuance of drugs prescribed by doctors
The pharmacist dispenses drugs prescribed by the doctors to patients.

5. Conclusion

The explosive growth in ICT and the internet in Nigeria is remarkable, but harnessing these tools to solve problems facing the economy's critical sectors (health) remains a daunting task for policymakers.

We are still behind as record keeping in most hospitals in the country is still manually done; automating and harmonizing these records to have a central database that will act as a pool for medical records requires the self-will of appropriate stakeholders in the Government.

The success of mHealth in Nigeria is largely dependent on having a national electronic health record system that is secured and can accommodate the integration of most stand-alone mobile health apps in the country.

References

[1] Nasiru Sanni, R. K. Manohar, and Mohammed A. Alkali, "Factors Hindering the Adoption of Digital Record in Nigeria; A Systematic Review of some Literatures," *International Research Journal of Management Science & Technology*, vol. 8, no. 10, pp. 60-61, 2017. [Google Scholar]

[2] Ruby Sahney, and Mukesh Sharma, "Electronic Health Records: A General Overview," *Current Medicine Research and Practice*, vol. 8, no. 2, pp. 67-70, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[3] Lynn Waithera, Joy Muhia, and Rogers Single, "Impact of Electronic Medical Records on Healthcare Delivery in Ksii Teaching and Referral Hospital," *Medical & Clinical Reviews*, vol. 3, no. 4, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[4] Demokaan Demirel, "Effectiveness of Health Information Systems Applications: Clinical Information and Diagnosis-Treatment Systems in Turkey," *European Journal of Multidisciplinary Studies*, vol. 2, no. 5, pp. 117-124, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[5] Ittipong Khemapech, Watsawee Sansrimahachai, and Manachai Toahchoodee, "Telemedicine- Meaning, Challenges and Opportunities," *Siriraj Medical Journal*, vol. 71, no. 3, pp. 247-248, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[6] Matthew. N. O. Sadiku, Adebowale E. Shadare, and Sarhan M. Musa, "Mobile Health," *International Journal of Engineering Research*, vol. 6, no. 11, pp. 450-451, 2017. [CrossRef] [Publisher Link]

[7] Everleen Wanyonyi et al., "*Effectiveness of Security Controls on Electronic Health Records*," *International Journal of Scientific & Technology Research*, vol. 6, no. 12, pp. 47-54, 2017. [Google Scholar] [Publisher Link]

[8] Mohammed Ibrahim, Yusuf Kani, and Emtithal Ahmed, "Examining the Impact of Implementation of Electronic Health Record System for Effective Health Management in Katsina State Hospitals, Nigeria," *International Journal of Gastroenterology*, vol. 3, no. 2, pp. 27-34, 2019. [Google Scholar]

[9] Olayiwola W. Bello et al., "*Driving Electronic Health Record System Implementation in Nigeria: A Proposal*," 1st International Conference of IEEE Nigeria Computer Chapter In collaboration with Department of Computer Science, University of Ilorin, Ilorin, pp. 200-204, 2016. [Google Scholar] [Publisher Link]

[10] Igbo Gabriel Alobo et al., "Implementing Electronic Health System in Nigeria: Perspective Assessment in a Specialist Hospital," *African Health Sciences*, vol. 20, no. 2, pp. 948-954, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[11] Sarumi Jerry, and Idowu Sunday, "Implementation of an Efficient Digital Health Care Delivery System in Nigeria," *World Wide Journal Multidisciplinary Research and Development*, vol. 2, no. 7, pp. 1-5, 2016. [Google Scholar] [Publisher Link]

[12] Chidinma M, Nduukwe and Bright U, Ezeoha, "A Hybrid of Electronic Health Record (EHR) System and Health Maintenance Organizations (HMOs): A Sure Way to Improve Healthcare System in Nigeria," *International Journal of Computer Science and Mathematical Theory*, vol. 4, no. 3, pp. 14-22, 2018. [Google Scholar] [Publisher Link]

[13] Nasiru Sanni, R. K. Manohar, and A. Mohammed Alkali, "Factors Hindering the Adoption of Digital Record in Nigeria; A Systematic Review of some Literatures," *International Research Journal of Management Science & Technology*, vol. 8, no. 10, pp. 59-68, 2017. [Google Scholar]

[14] Nasiru Sani et al., "Assessment of Patient Healthcare Record Management Practices in Tertiary Health Institutions of Jigawa State," *International Journal of Advanced Technology in Engineering and Science*, vol. 4, no. 5, pp. 154-161, 2016. [Google Scholar] [Publisher Link]

[15] Victor Alangibi Kiri, and Aaron C Ojule, "Electronic Medical Record System: A Pathway to Sustainable Public Health Insurance Schemes in Sub-Saharan Africa," *Nigerian Postgraduate Medical Journal*, vol. 27, pp. 1-7, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[16] Orna Finally et al., "Successfully Implementing a National Electronic Health Record: A Rapid Umbrella View," *International Journal of Medical Informatics*, vol. 144, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[17] Ather Akhlaq et al., "Barriers and Facilitators to Health Information Exchange in Low and Middle Income Country Settings: A Systematic Review," *Health Policy and Planning*, vol. 31, no. 9, pp. 1310-1325, 2016. [CrossRef] [Google Scholar] [Publisher Link]

[18] Michael Kavuma, "The Usability of Electronic Medical Record Systems Implemented in Sub-Saharan Africa: A Literature Review of the Evidence," *JMIR Human Factor*, vol. 6, no. 1, pp. 1-11, 2019. [CrossRef] [Google Scholar] [Publisher Link]

[19] Ahmed Baita Garko, and Usman Mahmud, "Design and Implementation of Outpatient Management System," *International Journal of Advanced Academic Research*, vol. 3, no. 6, pp. 13-22, 2017. [Google Scholar]

[20] Abdullahi Hassan et al., "Patients' Satisfaction after Electronic Medical Records Implementation in a Tertiary Hospital in North Central Nigeria," *Annals of Medical and Health Science Research*, vol. 8, pp. 94-98, 2018. [Google Scholar] [Publisher Link]

[21] Dr. Azeez Ajani Waheed et al., "An Integrated and Secured Web-Based Electronic Health Record," *International Journal of Recent Engineering Science*, vol. 8, no. 4, pp. 19-26, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[22] Ismail Keshta, and Ammar Odeh, "Security and Privacy of Electronic Health Records: Concerns and Challenges," *Egyptian Informatics Journal*, vol. 22, no. 2, pp. 177-183, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[23] G. Timothy et al., "Balancing Demand, Quality and Efficiency in Nigeria Health Care Delivery System," *European Journal of Business and Management*, vol. 6, no. 23, 2014. [Google Scholar] [Publisher Link]

[24] T O. Oyegoke, Rhoda Ikono, and Hettie Abimbola Soriyan, "An Integrated Health Management System for National Health Insurance Scheme in Nigeria," *Journal of Emerging Trends in Computing and Information Sciences*, vol. 8, no. 1, pp. 30-40, 2017. [Google Scholar] [Publisher Link]

[25] Top 5 Mobile Health Apps in Nigeria, 2020. [Online]. Available: https://gageawards.com/top-5-mobile-health-apps-in-Nigeria