A Usability Framework for Electronic Health Records in Nigerian Healthcare Sector

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Abstract

The usability of Electronic Health Record systems, while recognized as critical for successful adoption and meaningful use, has not historically received the same level of attention as other software features, functions, and technical requirements. In the Nigerian healthcare sector, it was observed that only few had adopted the use of electronic health record. The traditional method of keeping patient records which involves the use of paper and files is the system that is practiced till date. This paper-based system had been useful but no longer adequate as a result of some likely errors that occur like illegible handwriting of medical practitioners, improper care of patients' record, poor accessibility rate to patient's files, high cost of registration and payment for treatments; as well as wrong diagnosis due to inaccurate diagnostic decisions made. Although there are numerous EHR in market and due to the importance of this software, it is necessary to determine the usability of the software. Hence, this paper proposed a framework that enhances the usability of Electronic Health Record systems in Nigeria healthcare sectors.

Keywords- Electronic Health Record (EHR) system, Paper-based system, Healthcare sector, Adoption, Usability.

I. INTRODUCTION

Electronic Health Records (EHRs) are clinical support tools with the potential to reduce strains on clinician memory and cognition while improving efficiency in workflow and effectiveness in care quality and coordination [1]. The widespread adoption of EHR holds the promise of transformational change in the way health care is delivered, i.e. improving quality, enhancing safety, and reducing costs. The increased availability of patient information and decision support at the point of care has tremendous potential for reducing errors and increasing evidence-based care delivery[2][3]. Healthcare sectors in Nigeria presently are embracing the use of information technology (IT) and it is been utilized at a high rate; though the rate of adoption and usability of EHR system in Nigeria is very low. Several health sectors still use the traditional paper-based method of keeping records of patients' information. The paper-based system had been very useful but there is the need to adopt and integrate EHR for better and reliable services by the practitioners in the health sector. According to a report from the Institute of Medicine, it was estimated that about 98,000 U.S. patients die annually due to preventable medical errors, many due to lack of access to complete patient information [4]. Also subsequent studies have confirmed that inadequate information systems in U.S. clinics, hospitals and physician practices affect the quality of care patients receives [5]. If the proper record was taken, the same situation would have definitely happened in Nigeria as a result of the slow pace of adopting and using EHR. In U.S, Netherlands and some other developed countries, electronic means of storing patient records has been embraced for over 20 years, as researchers are working hard to facilitate optimal interchange of the records stored electronically amidst different institutions with an end-goal of having a National hub of Patient records. On the other hand, the opposite is the case in the Nigerian healthcare sectors as they are slowly embracing EHR because of poor infrastructures and high cost [6]. Therefore, the focus of this work is to develop a framework that enhances the usability of Electronic Health Record systems in Nigeria healthcare sectors. The remaining part of the work is

arranged as follows: section 2 presents the literature review, section 3 discusses the usability of EHR, section 4 presents the proposed framework for EHR usability and section 5 presents the conclusion and recommendation.

II. LITERATURE REVIEW

[7] explained how interoperability and privacy issues present significant barriers to implementation of the EHR by the patients, even though the technology facilitates patient care by providing clinicians with the ability to review a more complete medical record. The final Stark rule and Anti-Kickback safe harbors laws were introduced to potentially remove certain obstacles to successful implementation of EHR. The study further mentioned how President George Bush's administration outlined initial necessary steps to transform the healthcare delivery system through adoption of interoperable electronic health records (EHRs) by the year 2014. Despite this, the author did not consider security issues related to patients information while interoperating. [1] presented a unified framework of EHR usability, called TURF, which is a theory for describing, explaining, and predicting usability differences, a method for defining, evaluating, and measuring usability objectively. TURF defines usability as how useful, usable, and satisfying a system is for the intended users to accomplish goals in the work domain by performing certain sequences of tasks. TURF stands for Task, User, Representation, and Function, which are the four components that determine the usability of an EHR system. The paper stated that usability cannot only be defined scientifically under a coherent unified framework; it can also be measured objectively and systematically. It also defined usability around the representation effect along three dimensions: useful, usable, and satisfying, and listed a set of representative measures for each of these three dimensions.

[8] studied and identified the willingness of users via the main dimensions of readiness for E-Health systems for the success of health informatics. The work studies the willingness of adopting EHR in developing countries like Pakistan and it was observed that the willingness assessment is more crucial because the demographic impacts were more severe. It was also observed that the implementation of E-Health systems in most of the developing countries has not been so good because of the practitioner's (doctors) resistance due to advanced mode of IT-applications for health organizations. The gap in this work is that the authors did not consider the learnability and usability of the system by the intended users.

[9] appraised the impacts of usability on the interoperability of electronic healthcare systems and it also examined the ways of ensuring usability amongst interoperating electronic healthcare systems. They identified the problem of usability as one of the major obstacles of electronic health systems interoperability. Also, it was stated that the ability of healthcare providers to accept and use electronic healthcare systems for information exchange successfully depends on how well the user interface of the electronic healthcare systems have been designed.

III. USABILITY OF ELECTRONIC HEALTH RECORD (EhR) SYSTEM

The adoption of EHR systems in health sector is very vital in promoting effective healthcare delivery especially when the system interoperate with other EHR systems. The EHR is very useful as it includes patient demographics, problem lists, financial data, clinical documentation, order information, laboratory and diagnostic test results, medications and allergies, clinical events monitors, preventive care recommendations and decision support tools that enhances the efficiency and effectiveness of patient care. Usability of EHR is the effectiveness, efficiency and satisfaction with which the intended users can achieve their tasks in the intended context of product use [3]. This concept is critically important in promoting both the widespread adoption and meaningful use of EHRs. Adoption of EHR plays roles in clinical practice as it evolves through the merging of health information exchanged data and new forms of comparative effectiveness collated and made available for clinical decision support. The increased rate of availability of patient information and decision support at the point of care has remarkable potential for reducing errors and improving the delivery of evidence-based care. In line with this, EHR plays several roles which can be listed in four primary functions required to achieve effective and efficient results. They are:

- **Memory aid:** This reduces the need to rely on memory alone for information required to complete a task. It gives prompt and easy access to patient's information required.
- **Computational aid:** Reduces the need to mentally group, compare, or analyze information. It provides contextual view of overall patient health in details.
- **Decision Support aid:** Enhances the ability to integrate information from multiple sources to make evidence-based decisions and recommends care based on patients characteristics.
- **Collaboration aid:** Enhances the ability to communicate information and findings to other providers and patients, and incorporates information from other sources [3].

THE NEED FOR USABILITY OF EHR

Usability of EHR will facilitate communication amongst healthcare practitioners during meaningful exchange of information as it will enhance efficiency during interoperability. It will reduce medical errors, enhance better clinical decision making by integrating patient information from multiple sources, improve patients safety, improve efficiencies and lower health care costs by promoting preventative medicine and improved coordination of health care services, as well as reducing waste and redundant tests.

IV. PROPOSED FRAMEWORK FOR EHR USABILITY

This work provides the proposed framework for the usability of EHR. Usability is a quality attribute that assesses how easy a product is to use. Usability of EHR means how useful, usable, and satisfying a system is for the intended users to accomplish goals in the work domain by performing certain sequences of tasks [1]. A system is fully useful if it includes the domain and only the domain functions that are essential for the work, independent of implementations. Exploration of EHR usability has been identified by the Agency for Healthcare Research and Quality (AHRQ) as an opportunity for innovation in health IT with the potential for significant impact on clinical practice. The designed user interface for information displays is central to ensuring EHRs effectiveness, and efficiently supports clinical tasks such as memory aid, computational aid, decision support aid and collaboration aid. Importantly, both functionality and usability are essential elements of success of EHR as it must provide the correct elements of functionality necessary to support clinical tasks as well as provide that functionality in a way that adheres to proven design principles necessary for efficient and effective use.

In order for the EHR to be usable, the system should be interactive with the user to provide necessary system information when needed; it should be easily accessible and flexible. The information should be presented in a way that naturally represents the expectations and previous knowledge of the intended user, with the user interface well designed. EHR user interface design should be engineered to support and enhance rules-based decision making by highly practiced experts. This method of decision making is fast, economical of effort, and based on well-encoded individualized "procedural knowledge" [3]. The framework emanates from the components as shown in figure 1.

COMPONENT	ESSENTIAL FUNCTIONS	APPLICATION EXAMPLES
Administrative processes	Ability to conduct all financial and administrative functions associated with institutional operations and patient management.	Admissions/registration Scheduling Claims processing Administrative reporting
Communication and connectivity	Provides a medium for electronic communication between healthcare providers and patients.	Email Text/web messaging Integrated health records Telemedicine
Decision support	Provides reminders, alerts, and resource links to improve the diagnosis and care of the patient.	Medication dosing, allergies Risk screening/prevention Clinical guidelines Resource links
Dentistry and optometry	Ability to incorporate dental records and vision prescriptions.	Dental records Vision records
Health information and data	Ability to enter and access key information needed to make clinical decisions.	Patient demographics Problem lists Medical/nursing diagnoses Medications/allergies Results reporting
Order entry management	Ability to enter all types of orders via the computer system.	Laboratory Pharmacy Radiology Other orders
Patient support	Provides patient education and self-monitoring tools.	Discharge instructions Computer-based learning Telemonitoring
Results management	Provides the ability to manage current and historical information related to all types of diagnostic reports.	Laboratory tests Radiology reports Other procedures
Population health management	Provides data collection tools to support public and private reporting requirements.	Public health system Disease surveillance Bioterrorism

Figure 1: Components of EHR [10]

These components are therefore put together with some features to determine the usability of an EHR. The features considered are the following: learnable, efficient, memorable, usable, useful and satisfying. These are the qualities of an EHR that makes it adoptable and usable for Nigeria healthcare sectors. The proposed framework is shown in figure 2 below.

- **Learnable:** The ease with which users are able to accomplish basic tasks the first time they encounter the system makes it learnable. It involves the physical and/or intellectual skill required to learn the system. The EHR system should be easy to learn by the diverse user group so as to enhance its usability.
- **Efficiency:** This relates to the time it takes to become moderately efficient in the use of the system. Also, the rate at which the user performs and accomplish task with the system after it has been learned determines its efficiency.

- **Memorable:** It has to do with the ease of re-establishing proficiency when users return to a system after a long period of not using it. The system should be designed in a way to aid the ease of remembrance of the functionalities of the system by the occasional users.
- **Usable:** It has to do with the fitness of the system for use. It should be usable to support the users in real life task.
- **Useful:** It has to do with the usefulness of the system in performing or solving a specific task and arriving at a useful result that can support the users in real life task.
- **Satisfying:** This defines how satisfied the users are with the system. It is a subjective assessment of the pleasantness of the design. It is usually obtained through questionnaire or other related interview techniques to judge the users attitude towards the system [11].
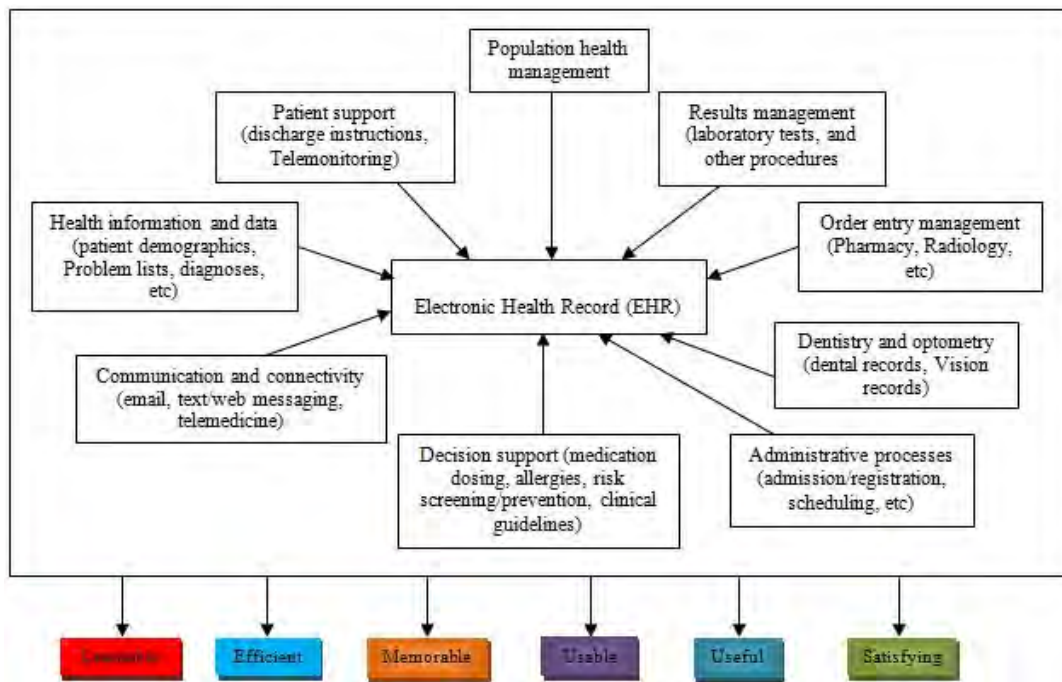

Figure 2: Proposed framework for usability of EHR (Source: Researcher's model, 2015)

V. CONCLUSION AND RECOMMENDATION

Usability is a quality attribute that assesses how easy a product can be used. Usability of EHR depends on how useful, usable, accessible and satisfying a system is for the intended users to accomplish goals in the work domain by performing certain sequences of tasks. In this paper, a framework that enhances the usability of EHR was proposed having learnability, efficiency, memorability, usability, usefulness and satisfaction as the qualities or features that make EHR adoptable and usable for Nigerian healthcare sectors. In essence, it is recommended that every EHR to be designed and adopted should be flexible. Also, information should be presented in a way that represents the expectations and previous knowledge of the intended user. In further works, researchers can adopt this framework while developing an EHR to increase its rate of adoption and usability in Nigerian healthcare sectors.

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