Improving Quality and Access to Healthcare by Adopting Emerging Technologies

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ABSTRACT

Shortage of healthcare workers (HCWs) hampers treatment outcomes in Sub-Sahara Africa (SSA). There is also a great need for scalable, cost-effective and long-term strategies in healthcare. The benefits of e-Government, the integration of innovative Information and Communication Technologies (ICTs) to conveniently provide access to services and data, are yet to be realized. m-Health is an emerging concept with potential to revolutionize delivery of healthcare. Mobile phones and other emerging technologies have the potential to change healthcare for the better when used as an enabler to provide immediate and secure access to critical clinical information. This exploratory study aims to discover ideas and insights on the integration of emerging technologies with Electronic Health Records (EHRs). The research identifies constraints and concerns associated with the setup of EHR systems as well as outline the potential for integrating emerging technologies to the provision of quality access and healthcare and treatment outcomes.

KEYWORDS

Emerging Technologies, Quality Healthcare, Healthcare providers, EHRs, Mobile Phone Technologies

1. INTRODUCTION

Emerging Technologies (ETs) are defined as innovations that are in development and have a potential to transform an industry [1]. ETs have the potential to alter an industry landscape resulting in numerous implications on policy and practice [2]. ETs arise from new knowledge and lead to rapid developments and capabilities, which sometimes disrupt existing processes and procedures [3]. A potential mechanism to reduce medical errors is adopting ETs in the provision of healthcare is proposed [4] in this study. A number of technologies including biometrics, mobile phones, cloud computing, big data and predictive analytics have been identified as ETs [5-9]. Healthcare workers in Low and Middle Income Countries (LMICs) face challenges of low pay, poor working conditions, and, overused and outdated infrastructure leading to migration to other countries [10].

1.1 Rationale

Sub-Saharan Africa is greatly affected by migration of their health professionals leading to an ever rising shortage of service providers. The delivery of services is also being affected by the HIV/AIDS burden [11]. Consumerization of devices has led to health workers bringing smartphones, tablets and other technologies to their workplace to meet their desire for personalized and anywhere access. This has enabled the mobilization of the Bring Your Own Device (BYOD) concept in healthcare [12]. This paper explores the potential benefits of integrating the above mentioned emerging technologies in healthcare.

2. LITERATURE REVIEW

2.1 Biometric Technologies

Biometric technologies are defined as automated identification and verification of persons using unique biological characteristics, that cannot be stolen, forgotten, forged or exchanged [13].The need for data security and confidentiality, by both healthcare workers and patients, has resulted in the integration of biometrics in service provision at many health facilities. The flexibility of this technology, its adaptability to varied environments is strengthening biometric integration. Furthermore, the need to access, share and exchange medical information demands trusted processes and procedures for the exchange of data by healthcare professionals. Biometrics could provide this security, and thus create operational efficiencies by ensuring treatment is tied to a patients identity. An opportunity exists for a universal patient identification system with the use of biometrics for identification [14].

Fraud in healthcare is also posing a big challenge. Falsification of patient records and identify theft has led to false claims, or unauthorized access to services, or billing for "phantom claims". Biometrics makes it possible to verify every treatment encounter leaving a verifiable audit trail [15-17]. Further, the integration of biometrics in healthcare will compliment compliance to industry and government regulation [18].

2.2 Cloud Computing

Cloud computing is a model for enabling ubiquitous, convenient, and on-demand network access, to a shared pool of configurable computing resources, that can be rapidly provisioned and released, with minimal management effort or service provider interaction [19]. The healthcare industry has been slow to adopt this emerging technology compared to other industries [20, 21]. Adoption of this emerging technology is promising, and could bring tangible benefits that may include lower costs, better quality and accessibility of healthcare [22, 23].

Storage and sharing of patient data could be enabled by the use of the cloud. Data could be shared easily in multiple health facilities, without duplication and redundancy, improving quality of care and treatment outcomes [24]. EHRs are usually patient centered, and need to be accessible on-demand to inform patient treatment. The cloud infrastructure could serve as an enabler in data sharing across multiple locations [25]. Healthcare organizations will thus be able to better deliver their core mandate of healthcare, rather than spending unnecessary time on the technology setup and maintenance, as on-demand critical data will be facilitated by cloud storage [26]. Cloud technologies also interface with mobile phones, another emerging technology seamlessly [27]. Thus these two forms of technology could be adopted in tandem to realize greater benefits.

2.3 Predictive Analytics

Big Data is defined by the volume, velocity, variety, veracity and value of the data [28] Big data analysis provides the potential of data patterns, thus better informing diagnosis and treatment in clinical informatics Predictive analytics could better inform clinical decision support systems, disease surveillance and public health management. Healthcare providers will also be able to make better and more informed diagnosis. The analysis of patient characteristics, cost and treatment outcomes will inform clinically cost effective care to patients. Enhanced data analysis provided to decision makers will inform policy and programming in healthcare [29].

The availability of patient management applications on mobile devices could support patient-driven case-based surveillance of care and treatment, adherence to treatment, and detect trends that enhance positive health outcomes [30]. Analytics will make it possible to provide patients with up-to-date information on the treatment decisions and programs associated with their illnesses [31].

2.4 Mobile Phone Technologies

There are close to 5 billion mobile phone subscriptions in the world, with over 85% of the world's population now covered by a commercial wireless signal [32]. Mobile phone technologies offer effective ways of increasing access to healthcare in LMICs, the cost and penetration of handsets is high and the numbers are growing. Mobile phones have improved Healthcare by providing treatment compliance, public awareness through SMS alerts, clinical follow-up information, and disease management details [33].

Mobile phones can help in chronic disease management. Elderly and expectant mothers can be empowered through real-time management reminders and monitoring thus improving treatment outcomes [34]. Mobile phones are regularly increasing in computing power and functionality. They are becoming much smaller, lighter and less expensive, thus enhancing their portability. The fact that the portable devices ubiquous makes it suitable to deliver regular health information to patients. Mobile phone based infrastructure is being piloted in a number of healthcare setups for health monitoring, treatment support and access to clinical information by providers. The seamless integration of EHR is making mobile phone technologies very useful [35].

3. RESEARCH DESIGN

This research applied an exploratory research design with a goal to discover ideas and insights of integrating mobile phone technologies an emerging technology, with EHRs. The research aims to identify potential problems associated with the setup of EHR systems It also explores the opportunities available for integrating mobile phone technologies to provide quality healthcare and health outcomes. The aim of the exploratory research conducted was threefold: to provide a better understanding of a patient's access to health care; to document patient data flow; and to map service delivery points. Through this research, a conceptual model of integrating mobile phone technologies into EHRs, was developed.

4. RESULTS

An electronic interview guide was sent to 20 healthcare providers in March 2014, 16 providers responded. The participants included 7 nurses, 5 doctors, 3 clinical officers and 1 social worker as shown in figure 1 below. 60% of study participants were working or had ever worked in a health facility using paper-based health information system to record, store and retrieve patient data.
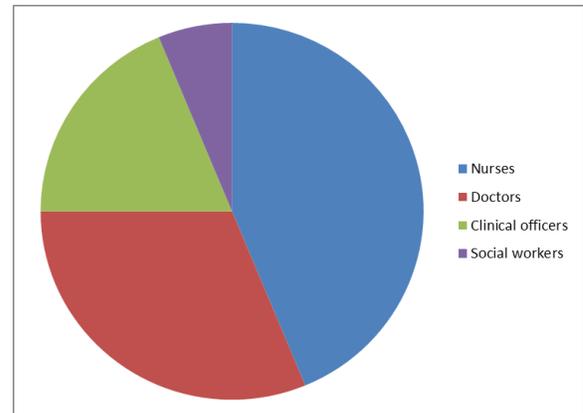

Figure 1: Distribution of respondents

The study respondents outlined a number of issues that would inform the conceptual model of EHR with emerging technologies. 40% of the respondents proposed that the EHR system could be used for patient diagnosis; 30% of the participants identified data storage and the remaining 30% patient records retrieval as shown in Figure 2 below.
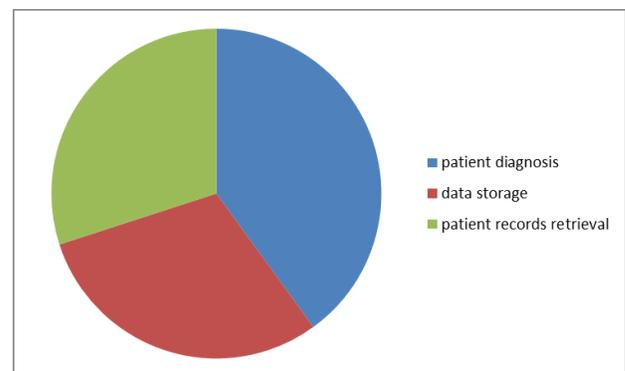

Figure 2: Usage of mobile phone technologies in EHR as proposed by the respondents

Quality of healthcare could be improved by the use of EHRs [36]. The system could enhance service delivery and efficiency, reduce patient waiting time, and prevent data loss. 50% indicated that less time would be spent by patients waiting for a service. This would encourage more patients to access healthcare and get treated. H healthcare providers will also benefit by being able to provide healthcare to a larger population.

90% of respondents identified the on-demand availability of patient records as very important. Mobile phone technologies would address this need. Further the errors of misplaced patient records, and a patient's laboratory results being mixed up, will be reduced by a reliable EHR system.

Other benefits of integrating emerging technologies with the EHRs were noted. Over 40% of participants felt healthcare could be scaled up with lean healthcare providers by technology enabling remote access of patient records from different locations. This could be achieved through the implementation of cloud computing. Patient data confidentiality was a big concern among the study participants. 60% of respondents' feared breach of patient confidentiality if the electronic data was accessed by unauthorized persons. To overcome this, patient data can be secured with security features such as a firewall, data encryption and secure wireless connection. Challenges envisioned by participants in the use of EHRs integrating emerging technologies included health provider skills, power failure, financing and related infrastructural needs.

Figure 3 demonstrates a conceptual model illustrating the EHR system setup with the adoption of emerging technologies, taking into consideration health provider's needs, concerns and suggestions.

The study respondents envisioned the EHR integrating emerging technologies of mobile phone and cloud computing to assist with patient diagnosis; data storage and records retrieval.
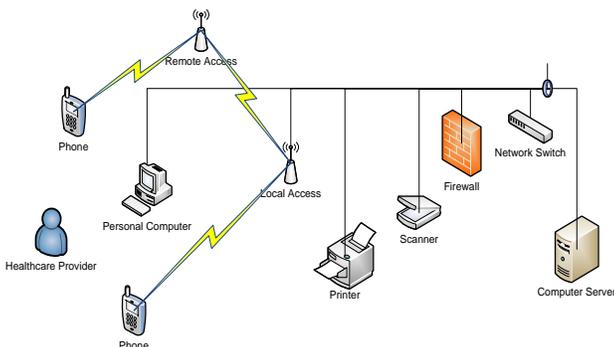
5. CONCLUSION

The continuum of healthcare can be well supported by an EHR that has interoperability capacities allowing multiple health facilities to share patient's data. This would make it possible for the clinical staff to access a comprehensive medical history of their patients. In LMICs, healthcare providers are not enough, EHRs integrating emerging technologies could support the scale up of services by available lean clinical staff remotely accessing a patient's investigation, current medical condition, exhibiting symptoms. The healthcare providers at the remote locations will be able to arrive at a diagnosis and relay their results back to the HER. This can increase healthcare access and reach patients even in remote parts of Kenya.

This research has identified benefits of integrating emerging technologies with EHRs. Future research could include a larger study to include healthcare providers in urban, rural and semi urban settings. This will help to evaluate the system usability and the cost benefit analysis of including emerging technologies in EHR systems.

Figure 3: Conceptual model of an EHR System Integrating Mobile Phone Technologies

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