On the Challenge of Adopting Standard EHR Systems in Developing Countries

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ABSTRACT

Electronic health record (EHR) systems are a popular mechanism for accessing health records in the developed world and have contributed towards improved and cost-effective health care management. However, the development of appropriate and scalable EHR systems in developing countries has been difficult to achieve because of certain limitations inherent in the technological infrastructure. In this paper, we present a comparative study of 19 EHR systems in terms of the security and usability of these systems within the context of the developing world. Our aim was to investigate whether online health services designed for developed countries can be adopted for EHR systems in developing countries. The investigation was based on a number of dimensions such as development environment, system platform, type and access control standards found in the National Institute for Standard and Technology (NIST) and Certification Commission for Health Information Technology (CCHIT). Our research indicates that all the systems evaluated require online access control decisions. Solely relying on an online access control system is limiting, particularly in developing countries where access to the server can be disrupted by a number of disastrous events.

Categories and Subject Descriptors

H.4 [**Information Systems Applications**]: General – Information Systems Architecture.

General Terms

Design, Security, Measurement, Performance, Human Factors, Standardization.

1. Summary

Over time, researchers have made significant efforts to design and implement electronic health record (EHR) systems, examples include, Dossia, sponsored by Wal-Mart, BP and AT&T and MyHealtheVet, sponsored by the United States of

Veterans Affairs. However, the development of appropriate and scalable EHR systems in developing countries has been difficult to achieve. The literature reveals many EHR systems that have not survived the test of time. Such systems include MEDCAB [3] and (FUCHIA) [4]. All the available literature indicates that these systems are no longer actively in use or development. Therefore, there is a need for more research to determine potential reasons for failures and disparities as well as the implications of these failures/disparities on clinical out.

Similarly, with the explosion of open-source EHR systems, more patients and physicians in developed countries are shifting towards accessing health information online. The $34 billion of incentives provided by the American Recovery and Reinvestment Act (ARRA) (2009) [1] has greatly increased the development of open-source EHR systems in developed countries. The ARRA Act further stresses that healthcare providers should deploy EHR systems that are certified for "meaningful use[1]" criteria which includes the implementation of access control. The intent of meaningful use criteria is to ensure that EHR systems can interoperate with other systems in order to enable electronic exchange of health information in accordance with all laws and standards.

While previous studies have widely documented the success and failure factors of ICT solutions in developing countries, there appears to be a gap in specifically answering the question of whether online health services designed for developed countries can be adopted for EHR systems in developing countries. Therefore, our aim is to guide researchers, development teams and regulatory organizations by assessing the potential and applicability of the current EHR systems in developing countries. This paper classifies and summarizes EHR systems and provides a framework for researchers to extract assertions and provide guided decisions. A set of assessment criteria was established to ascertain the degree to which the evaluated systems address technology constraints in developing countries, NIST[2] meaningful use and CCHIT[3] certification. Using these evaluation criteria, we evaluated 19 EHR systems extracted from online search databases.

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[1] http://www.healthit.gov/. Meaningful use is the set of standards that governs the use of electronic health record systems.

[2] http://www.nist.gov

[3] http://www.cchit.org

2. Evaluation Criteria

We identified three general dimensions from ICT4D technology interventions literature, NIST meaningful use and CCHIT certification, which were then broken down into eleven variables

Table 1: Framework classification variables

	Dimension	Variable
1	Technology	Development environments System platform System type
2	NIST Meaningful Use	**NIST-U1:** Users given unique name and/or number **NIST-U2:** Access controls with defined user privileges **NIST-U3:** Roles with emergency-time only privileges **NIST-U4:** Ability to activate emergency access roles
3	CCHIT Certification	**CCHIT-M1:** Users given least privilege permission set **CCHIT-M2:** Administrative facilities to assign privileges to users **CCHIT-M3:** User-based, context-based or role-based access control **CCHIT-M4:** User role revocation without having to delete user

3. Selection Procedure

The analysis of EHR systems was based on a systematic literature review method. The procedure for the selection of our articles is illustrated in *figure 1*.
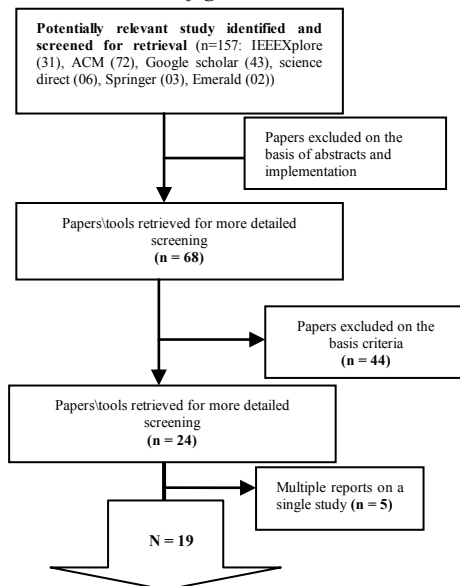

Figure 1: Review flow diagram

4. Results

Despite the flexibility proposed in the NIST and CCHIT certification with respect to access control, all the tools analyzed used role-based access control (RBAC). Our evaluation indicates

that all the tools analyzed are actively seeking to meet both NIST and CCHIT certification. All tools evaluated provide a set of pre-defined roles and permissions that an administrator can assign to users or groups of users. The pre-defined roles in the system represent a common role within the healthcare settings e.g. physician role, technician role etc. A user may be assigned one or more roles. Healthcare administrators have the ability to add any arbitrarily named role and assign it any number of privileges.

Our evaluation indicates that all tools meet the first two NIST meaningful use criteria (NIST-U1 and NIST-U2), and only four tools namely Microsoft HealthVault, Indivo, VitalChart and Dossia support emergency-time only privilege for user roles (NIST-U3). The lack of emergency access roles (NIST-U4) causes all the evaluated tools to fail to meet NIST meaningful use criteria. From the CCHIT certification, all the tools evaluated provide users with a given set of least privileges (CCHIT-M1), enables the administrator to define roles for the users that guide information access in the system (CCHIT-M2) and also allows user revocation without first having to delete users from the systems (CCHIT-M4).

Daglish and Archer [2] argue that patients need to be in control of their data such that those responsible for patients' care can perform their duty efficiently. Other reasons why patients need access to their health records include: records at the hospital server could be unreachable due to frequent power outages, unreliable internet connection to the server etc. However, all tools analyzed are designed towards healthcare providers. Patients have little or no access to their health records. Personal health record systems such as Microsoft HealthVault, Indivo and Dossia empower users with some access but the access must be online. In addition, all tools evaluated require online access control decisions. Solely relying on an online access control system is limiting, particularly in developing countries where access to the server is disrupted by a number of disastrous events. When the server becomes unavailable, for example due to power outages that is common in developing countries, access control decision cannot be made, making EHRs unreachable. We feel that in order for EHR systems to satisfy the intended users specifically in developing countries, existing systems needs to be extended on patient's mobile phones, such that records can be made available when hospital servers are offline. This will reduce the need to rely on online access control authorities in the provision of EHRs.

5. REFERENCES

1. American recovery and reinvestment act 2009, u.s.c. 111-5, 2009.
2. Daglish, D. and Archer, N. 2009. Electronic Personal Health Record Systems: A Brief Review of Privacy, Security, and Architectural Issues"*Proceedings of the IEEE 2009 World Congress on Privacy, Security and Trust and the Management of e-Business*, pages 110-120.
3. Kamadjeu, R. M., Tapang, E. M. and Moluh, R. N. 2005. Designing and implementing an electronic health record system in primary care practice in sub-Saharan Africa: a case study from Cameroon. *Inform Prim Care (*Jan 2005*)*, 13(3):179-186.
4. Tassie, J. M., Balandine, S., Szumilin, E., Andrieux-Meyer, I., Biot, M., Cavailler, P., Belanger, F., and Legros, D. 2002. Fuchia: a free computer program for the monitoring of hiv/aids medical care at the population level. *Int Conf AIDS*, (14:C11029).