Towards an Electronic Medical Record System for a Rural Haitian Medical Clinic

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While electronic medical records are a proven advancement in medical care their diffusion in developing countries lags far behind much of the world. The authors review requirements for development of an electronic medical record system for a rural Haitian medical clinic. Analysis is given to proprietary versus open source software along with hardware typology, implementation challenges and training. A recommendation is made for an approach that should be pilot tested to determine future research directions.

Keywords: electronic medical record, open source software, pilot testing, system typology

INTRODUCTION

Over the past decade electronic health records (EHRs) have been confirmed as an important component to improved health service efficiency. Some of the many benefits include better tracking of patient treatments, lower administrative costs for the healthcare provider, better patient statistical reporting, a more thorough and sustainable patient history and fewer medical errors (Blaya et al, 2010, Koppel, et al 2005). According to HIPPA's web site (Health Insurance Portability and Accountability Act) an EHR is defined as "…an electronic record of health-related information on an individual that is created, gathered, managed, and consulted by authorized health care clinicians and staff (HIPPA website, accessed 4/24/2018)." Since the effectiveness of healthcare services are dependent on an accurate and thorough patient history, the development of these types of information systems has proliferated over the last decade primarily in the developed world.

In the developing world the concept of EHR has been slower to advance and is primarily been limited to urban healthcare providers. Often paper systems are still the norm resulting in incomplete patient history with errors that impede proper healthcare, poor reporting statistics, weak security and, non-standardization of the record. The impediments to expansion of EHRs in developing countries are numerous, primarily dealing with limited financial resources, underdeveloped IT infrastructure and inconsistent electrical power (Fraser, et al, 2005). Low income countries also face further difficulties such as lack of engineering or technical expertise (Raut, Yarbrough, et al 2017). The absence of EHR systems can make already difficult situations more challenging by constraining human resource management, accounting and patient history (Whittaker, et al, 2015; Chaudhry, et al 2006).

In Haiti, the poorest country in the Western Hemisphere, over 6 million of its 10.4 million citizens live under the national poverty line of $2.42 (US) per day, with over 2.5 million (24%) living under the extreme poverty level of $1.23 (US) per day (World Bank web site, accessed 10-8-2019). EHRs are primarily limited to urban clinics and hospitals. In addition to the standard impediments of developing countries, Haiti has one of the lowest educational achievement levels in the world with 50% of its adult population being illiterate. Following Haiti's 2010 earthquake articles began appearing reporting on the use of the EHR by outside health workers involved in relief efforts yet little has appeared concerning the native adoption of EHR by Haitians, one notable exception being Fraser, et al's (2004) reporting of the implementation of the EHR system designed to treat HIV patients in rural Haiti.

PROPRIETARY VERSUS OPEN-SOURCE SOFTWARE

Proprietary EHR systems in the US and other developed countries continue to flourish as hospitals and medical practices strive to make themselves more cost-efficient. Leading software vendors in the US include Epic, eClinicalWorks, Allscripts, Practice Fusion and NextGen Healthcare. Their systems provide all types of EHRs with as little or much detail to patient and medical services as the purchaser desires. Proprietary vendors not only provide access to the software and databases but provide end-user training and support as well. The source code for proprietary systems is confidential and copyright or patent protected. It belongs only to the developer who developed it with the intention of making a profit from licensing, rental, or sale depending on the business model. Because of the expense of proprietary EHR systems their deployment has been largely limited to countries with developed healthcare systems.

Open source software (OSS) is nonproprietary in nature and is often developed in a not-for-profit manner. OSS opens the source code so that any programmer can review it to offer changes and improvements as well as fixes. OSS is most often distributed free of charge accompanied on occasion with minimal consulting fees for implementation and support. Not surprisingly, most developing countries have chosen the OSS approach for EHR systems.

The quality of OSS can be just as good as proprietary software because the salient difference is how each is developed. Proprietary software being developed by a team of computer scientists working for a profit-seeking company versus OSS which is built by a disparate set of computer scientists quite often working on a voluntary basis or for a nonprofit entity. Some experts would even argue that OSS products are more secure than proprietary systems because of the independent assessment of system security which takes place in OSS. Active and ongoing assessment by users and developers result in a highly secure environment. However commercial pressures experienced by proprietary software systems often make them more in user-friendly. Regardless, research indicates an OSS approach to EHR is a viable solution to overcome the problems of high costs and limited flexibility associated with proprietary systems (Aminpour, Sadoughi and Ahamdi, 2014).

Reisenwitz (2018) offers a look at seven of the leading open source EHR systems that can be summarized in Table 1. below:

TABLE 1
OPEN SOURCE EHR SOFTWARE PRODUCTS

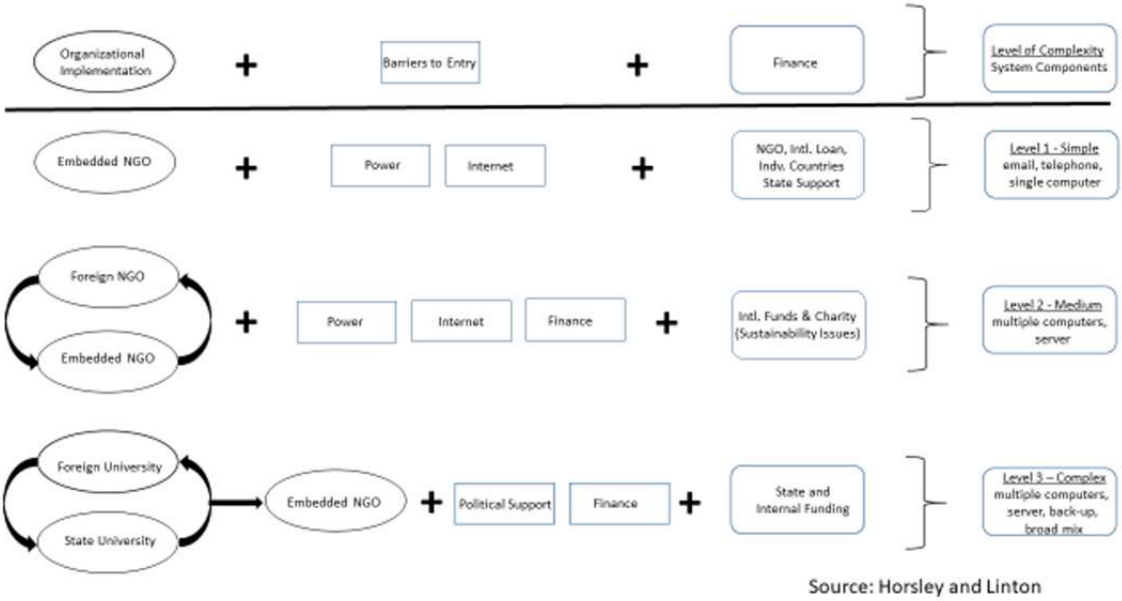
EHR System	Implementation	Salient Pros	Salient Cons
Practice Fusion	Cloud based	Auto updates Modern interface Full support Tablet integration	No evaluation and management coding No handwriting recognition
Open MRS	Stand-alone platform on local server or client-server based	Customizable without coding Add-on modules available	System experience needed Upfront set-up investment needed
VistA	Client-server based with web accessibility; developed by US Dept. of Veterans Affairs (VA)	Most familiar EHR system for doctors in the US Huge implementations throughout the US	Not as user friendly as recently developed systems No customization
FreeMED	Client-server based with web accessibility	Long standing support community	No recent updates
OpenEMR	Stand-alone platform on local server or cloud based	Active support community Customizable	User interface is a little dated
One Touch EMR	Cloud based	Auto updates Modern interface Tablet integration Voice recognition iPhone app	Needs more diffusion for support groups to develop
NOSH	Stand-alone platform on local server or cloud based	Interface is intuitive Many templates and forms Heavy end-user development	Up-front time investment required
Solismed	Cloud based	Offers patient portal Many applications	Not mobile responsive

SYSTEM TYPOLOGY

Since EHR systems vary greatly in implementation ranging from a standalone database on a PC and a small private practice to expansive multi-practice LAN developed systems to cloud-based systems covering hundreds of practices. Horsley and Linton (2012) proffer a three level typology of systems found in developing countries with similar demographics as Haiti as determined by the United Nations Human Development Index (see Exhibit 1). Their study compares implementations of the EHR in Haiti as well as 10 other countries; finding that typically some type of partnership is involved in system development, lack of electricity being a constant impediment as well as insufficient data connections and tele-connectivity and, lack of computer training. The simplest typology (Level 1) shows an embedded NGO, or in many cases a church, providing the internal support for the system. The system features a lone computer that utilizes the internet. Low internet penetration, monopoly mobile phone service along with spotty, unreliable power are the barriers to entry. Financial support is typically given by the NGO or

church plus the state. Level 2 is based on a case study in Haiti that featured and embedded NGO partnering with a foreign NGO to provide an EHR system for HIV patients. The study (Fraser, et al, 2004) saw 7,000 patients being monitored by the embedded NGO using internet at six rural locations. The financing for such an effort was provided by a grant therefore sustainability is an issue with Level 2. Level 3 is based primarily on a Kenyan case study that the authors identified as the only self-sustaining effort albeit from government support. It features a broad mix of computer systems with back-up that tracks over 50,000 patients.

FIGURE 1
EHR IMPLEMENTATION COMPLEXITY TYPOLOGY



Source: Horsley and Linton

IMPLEMENTATION CHALLENGES

Developing a sustainable EHR system for rural Haiti presents substantial implementation challenges. Kamadjeu, Tapang and Maluh (2005) noted a salient impediment in their Cameroon case study – lack of existing paper-based EHR system means no culture of even collecting data from patients. The study observed fourteen medical professionals (ten doctors, four nurses) in primary care situations regarding their ability to launch and sustain a EHR system, after a little over one year, eight professionals were still using the system. The reason for drop out varied from some of the professionals leaving, to poor computer hardware, to new facility management that did not support the effort. Professionals that participated in the experiment were typically young, computer literate and had research interests. The authors concluded that sustainability might be better addressed if systems were designed to fit the medical environment.

The environment of a rural Haitian primary care medical clinic will include non-existing or sporadic electricity and internet. Clinical staff in remote areas often have to function completely on their own without access to current medical information or support of more experienced colleagues (Fraser, et al, 2004). Locations have low literacy levels for patients with support staff having potential high school education along with low computer skills and database knowledge; without a culture of collecting data. In rural Haiti, Creole is the predominant language although French is spoken and understood by those that have at least some junior high or high school education.

SYSTEM SELECTION AND TRAINING

Due to its robustness and cost advantage, we recommend an OSS for rural primary care clinics in Haiti. We will test the Open MRS system developed by Open MRS a non-profit muli-collaborative led by the Regenstrief Institute of Indianapolis and Partners in Health (PiH) of Boston. Presently this software is being implemented in eight clinics or hospitals in Haiti due to the work of Partners in Health. Users would have the option of using French or English versions on a typology that would be likely be a combination of Level 1 (simple complexity) and Level 2 (medium complexity). We envision a single computer, with a foreign NGO providing financing for the project.

The selection of Open MRS gives the opportunity for interoperability with other ERH systems in Haiti given its present diffusion into rural hospital and clinic settings plus PiH's involvement. Interoperability of health information systems is deemed a fundamental requirement for accomplishing healthcare goals through informatics (Hammond, et al, 2010).

A number of potential user focused pitfalls in implementing such a system are found in Table 2 (Fraser, et al, 2005):

TABLE 2
IMPLEMENTATION CHALLENGES

User Problems	Technical Problems
Lack of user training	Lack of back-up system
Poor initial design	Poor system security leading to viruses
Systems too complex to use	Lack of power back-up
Lack of end-user involvement in design	Poor data back-up
Lack of perceived benefits from system	Lack of technical support
Dependence on one individual	

The user problems are addressed by beginning to instill a culture of capturing information. Doctor testimony and training of the benefits of EHR systems in the workings of patient care are required. Staff competencies will dictate what type of system is initially implemented. An older staff with limited computer skills could result in a paper-based system with data being entered into the computer from paper records. However, a younger staff with more developed computer skills could be trained for direct entry into Open MRS as it contains user friendly forms and intuitive navigation. The end-users will be engaged from the beginning of the project for feedback on system design, typology, security and implementation. Initially the system will have a physical internet firewall (i.e., no internet connectivity). Should an EHR be needed at a local hospital the patient will be given the record on a secure jump drive or a secure connection will be made with another computer for file transmission.

Years of teaching experience tells us that often "less is more" when it comes to learning new ways of doing things. The initial system will be as simple as possible yet highly functional. A physical internet firewall with a physically secured external disk back-up, single computer system using Open MRS will be easy to learn, very effective and secure. Multiple batteries must be available for power back-up.

CONCLUSION

Although EHR technology has proven itself to deliver better and less expensive healthcare its diffusion into developing countries has been limited with mixed results. The implementation of an EHR system in rural Haiti will be a challenging endeavor. A cultural change that recognizes the importance of patient history must first take place; learning that a health problem today can be better addressed by considering patient history should be learned. After that the numerous technical issues can be addressed.

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