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Experience Implementing OpenMRS to Support Maternal and Reproductive Health in Northern Nigeria

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Abstract

In Northern Nigeria a deteriorating health system has resulted in one of the World's highest rates of maternal and infant deaths. The dire situation in Northern Nigeria is only amplified by the lack of an effective health information system, leaving hospitals and clinics to make decisions about patient care with only uninformed guesses about medical history and access to unreliable and unintelligible patient registers and summary reports. In 2009 we implemented an electronic medical records system using OpenMRS for the Family Health Unit of the Shehu Idris College. The three-month process resulted in electronic forms for all clinical areas, greatly reduced data duplication and a monthly reporting process that takes minutes instead of days. This system provides not only access to the first patient-based health indicators in Nigeria (as opposed to previously error-prone aggregate data) but is also an example of the potential to overcome the harsh computing environment in Nigeria to implement eHealth systems that will improve the quality of patient care.

Keywords:

Computerized medical records systems, Nigeria, Reproductive medicine

Introduction

The Problem of Maternal/Child Health and Information Management in Northern Nigeria

The risk of a woman dying while giving birth in Nigeria is 1 in 18. In the poorer Northern parts of the country it can be as high as 1 in 13. For every woman that dies giving birth there are another 30 who suffer long-term and chronic ill health [1]. The story of child survival in Nigeria parallels that of motherhood with as many as 71 neonatal deaths in 1000 live births. A complete collapse of this system is only hindered by numerous NGOs and private foundations that in 2000 accounted for almost 90% of all health care spending [2]. While there now exist free or low-cost maternal and child health clinics, supported by several local and international agencies, these clinics are burdened by various paper-based "health information management systems". A typical data point is recorded 3-4 times and manually summarized monthly and quarterly. It can take weeks just to find the number of patients that attended a particular clinic. If it is not a research hospital or clinic (or specifically required to keep track by external funders) this information might not exist at all [3].

Towards a Viable Health Information Management System for Reproductive and Maternal Health with OpenMRS

To address the problem of maternal and child health and this crisis of information in Northern Nigeria, a team from the University of California Santa Cruz and the Shehu Idris College for Health Sciences and Technology (SICHST) put together an electronic medical records pilot at the Demonstration Clinic for the Family Health Unit (Asibitin Yara) in the Tudun Wada area of Kaduna. This pilot system, based on OpenMRS, is a complete clinical data system collecting information on antenatal visits, labor, child health, immunization and family planning. Between 60-100 clients and patients visit the clinic each week day and have their patient records created and updated without hindering or slowing patient care.

Methods

We describe the process to initiate a electronic medical records pilot and briefly explain how we identified the information "flows", technical literacy of clinical staff and the clinical use of computers and other technology. We then describe the process of converting the forms from each clinical area into OpenMRS, how the training was carried out, the design of the data entry procedures and how various technical and infrastructure issues were addressed.

Lastly, as of the writing of this paper, the pilot process is ongoing and in the process of expanding. We will describe the future expansion plans as well as plans to enhance the system to support clinicians at "point-of-care".

Results

A Clinical Information Needs Assessment

Beginning in June 2009, Evelyn Castle carried out an information needs assessment for staff of the SICHST Demonstration Clinic. The process began with a self-reporting survey to identify the use of information technology as well as skill and comfort level in both personal and clinical settings. The surveys were accompanied by in-context interviews and participant observation with ethnographic fields notes. Other clinical information needs studies have found the desire for "just-in-time" information at point-of-care and generally a need for ready access to patient-centric data [4, 5]. However in the Nigerian context there were significant barriers to information access including illegible handwriting, frequently missing patient cards, missing or broken equipment (ie for weight, blood pressure, etc) and social stigma especially around reporting HIV status, alcohol use and sexual history. These barriers resulted in a clinical culture where most types of data were rarely sought after, regularly seen as unavailable, and often not collected in the first place. The ONLY motivation for data collection, storage and reporting was because of mandate by the state government which sponsored this free clinic for women and children.

The SICHST Demonstration Clinic

The SICHST demonstration clinic is a government funded clinic in Tudan Wada, Kaduna. It provides free antenatal care, labor services, immunizations, child health care, family planning services, and reduced prices on pharmaceutical drugs.

Table 1 – SICHST staffing and workflow

Staff		Patients/Clients	
Doctors	0	Antenatal	60/day
Nurses	9	Child	40/day
Consultants	3	Immunizations	100/wk
Records Clerks	3	Family Planning	10/wk
Pharmacists	4	Labor	3/wk
Midwives	2		
Nannies/Guards	6		
Other Staff	3		

The staff at the clinic is made up of mainly women. Their age range is from straight out of school (22) to near retirement (65). The clinic is also frequented by young students doing practicals for their degree from SICHST. The technical experience of the staff is very limited. All of the staff owns a cell phone which they use frequently. The matron has a computer in her office, however she is unable to use it. Two of the Records Keepers have used computers in the past. Two of the consultants have used computers in the past and one is currently attending a computer programming class. Also, one of the pharmacists uses a computer for recreational purposes. Of the five staff members who are familiar with computers, 4 of them are male. No staff member had any knowledge of electronic medical record systems.

The use of technology in the clinic is non-existent. It contains one computer, which is not used. The only other technological devices it has is a television, a broken autoclave, a generator, and lights. The clinic receives light from PHCN infrequently and irregularly. When PHCN did supply power the voltage is too low to run many devices. The only reliable source of electricity came from the generator, which is often being refueled and repaired.

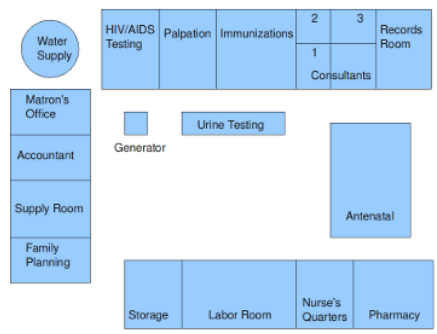

Figure 1-Layout of SICHST Demonstration Clinic

Clinical Records

Record Keeping at the clinic is all recorded on government forms or in hand-made log books.

Table 2 – Record keeping

Forms	Log Books
Antenatal, Immunizations, Family Planning, Child Health Care	Antenatal Check-in, Immunization, Out-patient register, labor and delivery

At the end of each month, the staff in charge of Record Keeping goes to each department and collects the information required by the Kaduna State Government. The information is gathered by going through the log books and counting each entry, one-by-one. The Kaduna State Government Monthly Summary consists of 7 pages with 76 questions, and 8 pages of tables. Each month the clinic is only able to supply answers to about one-third (1/3) of the questions.

Implementing OpenMRS

OpenMRS was quickly chosen as the platform from which to develop an electronic health information system to support maternal and child health because of it's existing deployments in similar low resource environments (ie Rwanda, South Africa and Kenya) [6, 7]. OpenMRS also existed in a range of deployment sizes from small clinics and large hospitals to networks of care centers. In addition OpenMRS was quickly able to be customized to support not only patient-based data

management but also aggregate data at the clinic, district and state level [8].

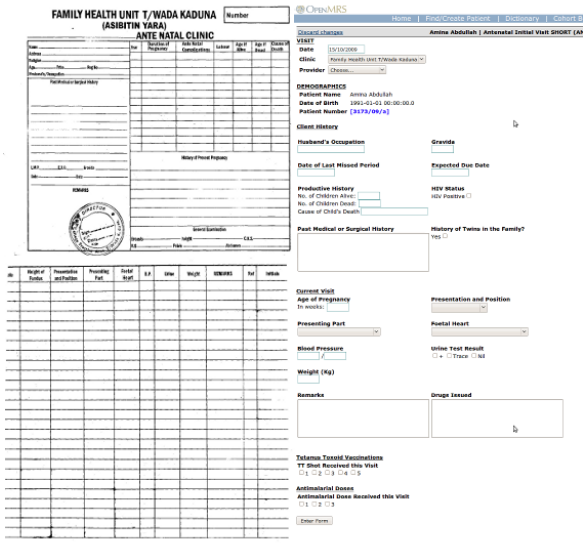

Figure 2- Antenatal Paper Card vs eForm

At the SICHST Clinic, the focus was to record Antenatal, Immunizations, Family Planning and Labor forms using OpenMRS. Two other departments, Child Health Care and Pharmacy would not be converted at this time since (1) there were no permanent paper forms and (2) in order to record these areas without extra burden, other equipment would be needed that there was not yet sufficient budget and training time.

The form conversion process did not result in an exact electronic copy of the paper form as is common for other OpenMRS implementations [7]. Instead since the patient cards were rarely completed in a correct or systematic way the electronic forms were made to match data that was ACTUALLY collected by the clinician. These electronic forms were revised over several iterations that involved simplifying data entry, adding drop down lists and check boxes whenever possible to speed up data entry. As well as creating alternative "short forms" to remove the clutter of other data fields that simply were not collected on the patient cards or registers.

To manage the data entry process a schedule was planned out after observing how the clinic runs and which services are offered each day. The volume of each service on particular days was such that the two data entry clerks could not keep up with the volume of data entry. Thus data entry was spread through the week and other staff that had computer skills would assist with back-log when time permitted.

	MONDAY	TUESDAY	WEDNESDAY
IMMUNIZATIONS	Enter all given today Enter all given Friday	Enter all given today	Enter all given today
ANTENATAL	Finish Thursday	Enter all from Monday	Enter all from Tuesday
LABOR	Enter all from Friday and over weekend	Enter all from Monday	Enter all from Tuesday
FAMILY PLANNING			

Figure 3- SICHST Demonstration Clinic Data Input Schedule

Reaction to OpenMRS and the Trainings

The initial reaction by the staff to OpenMRS was very positive. Most people at the clinic had never used a computer before but all claimed to be willing to learn. The people with past computer experience were more interested in learning OpenMRS.

Initially, training began with the two men in the Records Department, both who had previous experience with computers. They were able to understand OpenMRS and navigate the patient creation, patient look up and encounter form entry after only hours of introduction. The problems encountered while teaching were: language barrier, spelling errors, typing speed, and overall speed on computer. The clinic handles a large volume of clients each day and the overall speed of the two Records Keepers was not fast enough to record all the patients every day.

One of the causes of the overload of input data was because patients were coming for return visits. The Records Keepers not only had to input the information from the current visit, they were also required to enter the information from all the prior visits. We tried to combat this problem by focusing on entering in immunizations first (only the shots that children received during their current visit), then first time Antenatal clients, then second time Antenatal clients, and so on. Normally, we were able to finish all immunizations, and all first and second time Antenatal clients. However, in order for the Monthly Reports to give an accurate number of Antenatal clients and services, they will need to enter in the visits for all patients. This is projected to ease slightly with time as more and more of the clients/patients will have existing records in OpenMRS.

The other staff that received training were two women from Family Planning and two women from the Labor Department. After experimenting with teaching methods, it was concluded that it was most effective to have one of the men from Records do the teaching. The language barrier was too difficult to overcome and the staff seemed more at ease learning from one of their own colleagues.

OpenMRS Technical Setup

The computing environment even within the State's capital (Kaduna) proved to be very challenging. Another review of health informatics systems in Nigeria found the technical barriers to be the primary reasons for little to no adoption of these systems [3]. To combat the inevitable power and

maintenance issues, a simple setup was designed that used an OpenMRS server running on a single low-power Inveneo computer with a 500mhz processor, 1Gb RAM and a 40G hard drive. This server was connected to a network with another identical Inveneo machine. Another low-power ASUS Eee Laptop was connected via wireless when another data entry clerk was available. Both desktops were connected to battery backups that provide for two or more hours of work time when electricity from the "grid" or the generator were unavailable. Besides being simple to maintain, the equipment cost was under $1500 (USD). Other technical barriers revolved mostly around the clinic facility itself where several rooms did not have doors, locks, or correctly wired electrical outlets.

Discussion

Feedback from Clinical Staff

The implementation of OpenMRS proved to be very beneficial overall. Not only was the staff excited to learn OpenMRS, but they were also determined to keep the system running and up-to-date.

The clinic staff identified the following benefits of OpenMRS on their work in the clinic:

1. Saves time each month over gathering information manually
2. Gives an accurate report without human mistakes
3. Allows for more detailed analysis of data
4. Encourages staff to collect completed forms
5. Increase in clients because computers are associated with an advanced clinic

The feedback and buy-in from clinical staff was important early on. Having feedback rapidly implemented in the system created a high-level of personal and organizational investment into the system even after the main project implementors were no longer in-country.

Expansion Beyond the Demonstration Clinic: eHealth and Information Systems Nigeria

Nigeria is currently undergoing a public health crisis with regards to maternal and child health [9, 10]. In order to address this crisis, Nigerian clinics, hospitals and policy makers will need access to timely and accurate health information that can both influence policy as well as support patient care. To this effect it will be necessary to address the lack of an eHealth "ecosystem" in Nigeria. To support a robust health care information system, equipment vendors will need to exist that can provide low-cost, low-power equipment. Software and support service professionals will need to have the skills and expertise in implementing, customizing and extending platforms like OpenMRS. The authors of this paper are working towards these ends by (1) working with the SICHST to update a national diploma curriculum on Health Information Management Systems to include much more in-depth knowledge and hands-on experience with OpenMRS and other eHealth systems, (2) working with local vendors and software developers to understand the eHealth environment and provide equipment and services at reasonable costs and (3) creating effective partnerships with academic institutions, local and international NGOs as well as government institutions, to ensure a viable and sustainable health information system (see [11] for more discussion on creating effective eHealth partnerships).

Future Plans

Currently the Pathfinder International staff in Nigeria are evaluating our OpenMRS implementation and working with us to plan an expanded pilot in several clinics and hospitals that they manage and support financially. The goal is to have an "OpenMRS Nigeria Express" setup that will have ready to deploy hardware, software and power sources to extend the reach of important health informatics work into even rural parts of Northern Nigeria.

Conclusion

This project is a demonstration of the dramatic potential to revolutionize health information management in Northern Nigeria, possibly effecting millions of women and children over the next few years, with very little extra required in terms of resources, time and money. In many cases an effective and expanded use of OpenMRS will save time and money while opening up completely new possibilities for improved quality of care. The data collection alone will provide a never before seen view into the maternal and child survival crisis allowing the local and international community to come together and stay motivated and updated with important near real time information.

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