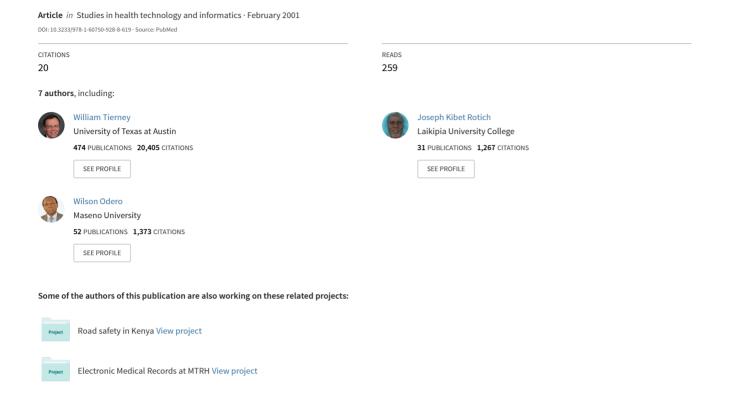# The MOSORIOT medical record system (MMRS) phase I to phase II implementation: an outpatient computer-based medical record system in rural Kenya

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The MOSORIOT Medical Record System (MMRS) Phase I to Phase II Implementation: An Outpatient Computer-based Medical Record System in Rural Kenya

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Abstract

The authors of this paper describe the second phase of the implementation of the Mosoriot Medical Record System (MMRS) in a remote health care facility on the outskirts of Eldoret, Kenya, located in sub-Saharan Africa.

We describe of the collaboration between Indiana University (IU) and the Moi University (MU), and the process that led to the development of the computer-based Mosoriot Medical Record System (MMRS) is provided. We then provide the conceptualization and initial implementation of this basic electronic medical record system.

We also describe the different processes for assessing the MMRS' effects on health care, including time-motion studies and a strict implementation plan that is necessary for the successful implementation of the system.

The MMRS project has many features that make it significant in the domain of CBPR systems. It may serve as a model for establishing similar, basic electronic record systems in the developed and developing world.

In developing countries there are few (if any) projects that have attempted to implement such a system.

This paper describes the planning, end-user education to new technologies, and time-motion studies necessary for the successful implementation of the MMRS. The system will be used to improve the quality of health data collection and subsequently patient care. It will also be used to link data from ongoing public health surveys and this can be used in public health research programs of the Moi University.

Keywords:

Sub-Saharan Africa, Eldoret, COBES, Computer-based medical records.

Introduction

Eldoret, Kenya in sub-Saharan Africa has characteristics of many third world countries. There exists widespread poverty, poor technology infrastructure, and rudimentary essential services such as those that supply electricity, telephone linkages and tap water.

Kenya, in common with many other African countries, is also experiencing an epidemic of HIV infection. This epidemic is occurring in association with the illnesses characteristic of third world countries such as tuberculosis, malaria, polio and rheumatic fever. (1)

A collaborative project between Indiana University and the Moi University Faculty of Health Sciences (IUMUFS) initiated in 1989 implemented a project with the purpose of enhancing medical education and public health research and this would hopefully influence the development of health care leadership in Kenya and the US. (2,3) All programs introduced through this collaboration must become self-sustaining by the Kenyan community if they are to achieve the expected benefits.

The Mosoriot Health Center

The Mosoriot Health Center (MHC) is located in a rural area some 25Km from the town of Eldoret. The center is the sole health care provider for the surrounding population of 30-40,000 and the number of patient visits per year is approximately 40,000. The clinic provides health services to adults, children under 5 years and antenatal care. It has very basic radiological and pathology services. The clinic charges 15 Kenyan shillings (approx. US$0.20) for each visit and the same amount for each medication prescribed.

The MHC administrators are required to produce from the paper-based records regular reports on clinics activities to the Kenyan Ministry of Health. This is a laborious task and contains many inaccuracies and is unable to be performed in an appropriate time frame.

The clinic has no longitudinal medical record, the patients have no unique identifier, data entry involves the constant re-entering of patient record numbers, complaints and diagnoses and the process is characterized by illegibility and transcription errors.

Evolution of the MMRS

The initial development of the MMRS occurred during the period February 1998 to January 2000. The process involved members of the project team (4), the senior Health Officer of the center, matron, director of medical records, nurses and other staff of the clinic.

The visits helped in the defining of the,

- Administrative and clinical needs of the clinic
- Data requirements (using the existing clinic data)
- Data dictionary
- Physical structure of the computerized system and its maintenance

One of the critical components of these initial visits was the development of a rapport with the clinic staff. It is this staff on whom the permanence of the system and it success depends. If an information system is not perceived as being useful and easy to use by the end users it will not be used.

There were special barriers the MMRS project team had to overcome before any implementation could occur.

There was the physical barrier of reliable computer power and its support in an environment with poor electricity supplies. This has been overcome using a single computer system that was dependent on the local electricity grid in combination with an uninterruptible power supply from solar and generator backup. The system has been designed to guarantee a reliable backup of the clinic data.

A second barrier to the success of the project was the lack of familiarity with computers amongst the Mosoriot Health Center (NHC) staff.

The MUFHS in its association with IU had developed a robust array of computer resources that included student and faculty computer laboratories. It was people from this facility in association with the Indiana University faculty that the training for the MHC would be obtained. This meant that the MMRS would be managed and sustained by the Eldoret community.

As there was no unique patient identifier for patients in the MHC (or elsewhere in Kenya) the MMRS was designed with a unique patient identifier to facilitate the registration of patients within the system.

The largest hurdle to establishing the MMRS was the transition from a paper-based record to an electronic medium.

To solve these problems we needed a system that,

- Was simple to use
- Provided no redundant data entry
- Meant data was entered once and once only
- Encouraged accuracy of data entry
- Reflected the clinical aspects of patient care as well as meeting the administrative and reporting needs of the providers.
- Was affordable

Data entry screen

The data entry screen for recording the current clinic data is displayed when a new patient is entered or an existing patient (accessed using their unique ID). The system is based on the commercial software Microsoft Access ®.

The database programmer from IU (FS) made program modifications utilizing the experiences of the two project team members who have been associated with the implementation of larger CBPR systems. (WMT, TJH). (5,6) The major part of these modifications was made during the October 2000 visit to Eldoret.

The onsite interactions between the members of the project team produced several benefits in the MMRS development.

Development time was accelerated, the system could be tested while the IU staff were in Eldoret, the end users could see the system as it developed and have input into its structure and functionality.

Access to a patient's record was facilitated by partial name matching and accurate data entry was promoted by implementing drop down tables that were prompted by any data entry that was outside the normal or absolute ranges for a given item. To retain a familiarity with the data entry used in the current MHC record only the data items that were currently in use at the MHC were defined for recording in the system.

Electronic data entry into most Computer-Based Patient Record (CBPR) systems remains a stumbling block in the development of these systems. Part of this problem can be overcome with the use of encounter form templates that are filled in by the data entry personnel (clerks, nurses, technicians), and from these data is entered into the system. This process is still used with the most advanced CBPR available at present. (5,6) Data capture and entry from these encounter forms forces more accurate data recording, they are acceptable to users and permits retrospective data entry. This latter feature has been useful in the MMRS development where data from the MHC was entered retrospectively from the time period January 2000 to October 2000. The data displays were then used for the

demonstration of the current MMRS to the people who would be using it in their daily work.

Data Dictionary

Successful CBPR systems require an effective data dictionary system and this dictionary must meet clinical and administrative requirements of the health care facility.

Therefore the data model for the MMRS needed to be simple yet accurately reflect the knowledge representation the 'clinical data' used in the MHC. (5-9) To achieve this representation of clinical knowledge with the limited resources available the data were recorded in an expandable small relational database, MS Access®. The terminology for the data dictionary was that currently utilized by the staff in the MHC and had been recorded (where possible) in accordance with the international standard ICD10.

Data stored within the MMRS data dictionary are the disease code, its classification (TERM TYPE), a text description and a costing where available.

The dictionary has the facility for updating (adding) new disease codes and the use of an internationally recognized disease coding system (ICD) without requiring any major changes in the database structure.

At the completion of the October 2000 visit by IU staff the core MMRS had been built and the next task was to undertake full implementation.

Reflecting patient care and meeting administrative reports

By utilizing the structure of the data dictionary, measurements of clinical activities within the MHC will be carried out using the report generator functions of the Microsoft Access ® database. Similar reports for administrators are produced without the requirement for additional data entry. This is because the administrative data elements (costs, disease frequency) are recorded when the clinical data are recorded. (7)

The Kenyan Ministry of Health requires monthly reports from clinics such as the MHC and these are currently produced by hand from the existing inadequate medical record system and consume large amounts of time and are costly to produce.

Despite the complexity and cumbersome design of these forms the IU programmer (FS) was able to reproduce these within the MMRS prior to the end of the October 2000 visit. When required by the Ministry of Health, the staff of the MHC will search the MMRS database and produce the reports within minutes. These can be printed or sent in electronic format (e.g. disk) to the relevant authority.

Phase II developments

Despite initial skepticism (and even resentment) by the staff of the MHC in the initial phases of the MMRS development

there was active encouragement for the project to be implemented during the October 2000 visit by IU team.

During the period February 2000 to October 2000 with the assistance of the MHC staff we found that new items were needed for the data dictionary, as these had not been found in the records during the initial visit. Improvements in the data entry screen, and modifications to the unique identifier were made and the new reports from the system were created.

Future developments

Currently the MMRS requires the continued expansion of the data dictionary to accommodate those terms that have become necessary since the initial developments.

Under work-study arrangements students with a clinical background will enter any new data dictionary terms and retrospective data from the clinics paper records. To ensure the quality and accuracy of this process one of the clinicians who resides in Eldoret (JJM) will review the data entry process and dictionary maintenance. There are several benefits from the retrospective data entry. It will test the efficiency of the data entry process. When the system is fully implemented it will be able to display longitudinal data from a retrospective record on individual patients. MHC reports can then be produced from valid data repositories.

It is also recognized that the implementation of the MMRS will have significant effects on the work patterns of staff within the MHC. The installation a new information management system can have significant effects on staff that can be positive or negative on data collection, patient care, costs and quality of care. (8,9)

It is therefore proposed that a series of time-motion studies documenting patient and information flows will need to be performed in association with the implementation schedule of the MMRS. It was considered that the three time frames for these studies should cover are,

1. Before implementation of any aspect of the MMRS.

2. After implementation of the patient registration or patient encounter form.

3. After full implementation of the MMRS

The time-motion studies that will be performed by the MUFHS medical students using hand-held Palm Pilot personal data assistants. They will be assessing those activities that were a priori were considered likely to be affected by the implementation of the MMRS. The IU-MUFS collaboration supports, in addition to the MMRS the Community-Based Medical Education and Service (COBES) program. This program is directed at improving the public health of Kenyans by enhancing medical education and public health research. (2,3)

The COBES Program, stresses the basic tenets of public health, and all Moi University medical students spend 25%

of their time in the first five years of medical school living among and gathering data from rural villages and urban areas on current health care problems and needs. The data generated by the COBES Program will provide the foundation for both problem-based learning and community-based public health in Kenya. Unfortunately, there isn't even sufficient paper to record these data, few computers and staff statistical skills for recording and analyzing them.

It is proposed that with the use of Palm Pilot personal data assistants supplied through the IU-MUFS program, students in the COBES project will collect public health data that will link with data within the MMRS system (i.e., subject's first name, last name, mother's first name, father's first name, and date of birth). This data will then be used to produce COBES reports that will be added to the COBES page on the IU Medical Library's Web site.

Discussion

As the MMRS enters the second phase of its implementation the critical factors in its ongoing success are built around the stakeholders in the system.

These stakeholders occur at all levels.

1. The patients-They remain closely involved in the project. They currently retain there record as a small, self-purchased, hand-written booklet. With the new MMRS they will be able to keep their record as a printed encounter form but the electronic data will be both more secure, accessible by providers, and linkable across visits.

2. The project development team. The MMRS model fits the expansion model of most established CBPR (5,6,7,8) and many of the core principals of these advanced projects are applied here and utilize the experience of two of the authors (WMT, TJH). Team integration to support the different aspects of implementation is essential.

3. Public health educators and students. Clinical and public health research within the Moi University will be enhanced through the expanding database within the MMRS and the COBES link.

4. MHC administrators now have an electronic system that will provide a more accurate measure of the centers activities and the program developments in October 2000.

5. The production of real-time reports from the clinics to the Kenyan Ministry of Health will mean that the government will become a de facto stakeholder by having available timely, reliable and accurate health data and information on health within its Mosoriot and Moi University communities. This will provide a model for enhanced health recording within Kenya.

Acknowledgments

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