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Healthcare

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Case Study

Implementation of electronic medical records requires more than new software: Lessons on integrating and managing health technologies from Mbarara, Uganda



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ARTICLE INFO

Article history:

Received 1 May 2015

Received in revised form

19 August 2015

Accepted 19 August 2015

Available online 26 September 2015

Keywords:

Electronic medical records

HIV

Data management

Change management

Building research capacity

ABSTRACT

Implementation lessons:

- Technology alone does not necessarily lead to improvement in health service delivery, in contrast to the common assumption that advanced technology goes hand in hand with progress.
- Implementation of electronic medical record (EMR) systems is a complex, resource-intensive process that, in addition to software, hardware, and human resource investments, requires careful planning, change management skills, adaptability, and continuous engagement of stakeholders.
- Research requirements and goals must be balanced with service delivery needs when determining how much information is essential to collect and who should be interfacing with the EMR system.
- EMR systems require ongoing monitoring and regular updates to ensure they are responsive to evolving clinical use cases and research questions.
- High-quality data and analyses are essential for EMRs to deliver value to providers, researchers, and patients.

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1. Background

The United States President's Emergency Plan for AIDS Relief (PEPFAR) and the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) began funding the Immune Suppression Syndrome (ISS) Clinic in 2004 and 2005, respectively. The ISS Clinic became a free antiretroviral therapy (ART) center, and patient enrollment jumped dramatically.¹ Clinicians relied on paper-based medical records to prescribe care for the 200 adult patients and 40 pediatric patients seen daily.

As patient volume grew, monitoring patient information over time using paper records became a greater challenge for clinicians and administrative staff. It also made using clinic data for research increasingly time-intensive and error-prone. Researchers from the

University of California San Francisco (UCSF) collaborating with Mbarara University of Science and Technology (MUST) to study treatment adherence found it nearly impossible to aggregate patient data and select study participants systematically.

The UCSF research team implemented an electronic medical record (EMR) system to increase the clinic's research capacity while streamlining patient care and stakeholder reporting. They quickly realized that the problem required more than new software. Many stakeholders, including the physicians, questioned the utility of the database, viewing it as a tool to promote UCSF's research agenda, and Ugandan partner institutions contributed limited financial support.

How could the UCSF team improve uptake of the new technology? How should they balance clinical, administrative, and research needs? To increase the database's viability they would need to convince stakeholders of its value and continuously adapt the system to meet the clinic's changing needs.

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2. Organizational context

In 1998, an American physician founded the ISS Clinic to provide care for HIV-positive patients. The clinic was located on the Mbarara University Teaching Hospital grounds and jointly managed by MUST and the Ministry of Health's (MOH's) Mbarara Regional Referral Hospital. In 2000, MUST invited Dr. David Bangsberg, an American researcher at UCSF, to help develop a pilot study on treatment adherence among poor HIV/AIDS patients. When Bangsberg saw how few patients could afford antiretrovirals (ARVs), he established the Family Treatment Fund to help finance treatment.

Bangsberg met ISS Clinic physician Dr. Mwebesa Bwana in 2003. Bwana had created a Microsoft[®] Excel spreadsheet containing data on the clinic's first 500 patients. He asked Bangsberg how to improve the spreadsheet to support research and reporting.

In 2004, UCSF and MUST officially launched a research partnership. Bangsberg hired a project director to manage the collaboration and supervise implementation of a new Microsoft[®] Access database for data collection and reporting. The project director hired a data manager and two data entry clerks to operate it.

By 2005 the database contained thousands of medical records, and system performance slowed. Concerned that Access could not keep pace with rising patient enrollment, the UCSF team seized the opportunity to be one of the MOH's three pilot sites for a new, open source EMR platform called the Open Medical Record System, or OpenMRS[®]. Bangsberg hired additional database staff and purchased equipment.

OpenMRS became operational at the ISS Clinic in 2007. By August 2008, the clinic had enrolled over 15,000 HIV-positive patients. That year, Bangsberg transitioned to the Massachusetts General Hospital (MGH) and launched the MGH-MUST Collaborative. UCSF continued to conduct research and collaborated with MGH.

3. Personal context

Bangsberg and Dr. Jeffrey Martin led the UCSF-MUST partnership. They had worked together previously on HIV adherence research. When Bangsberg arrived in Uganda in the early 2000s, some researchers were questioning whether patients in resource-limited settings would adhere sufficiently to ARV medications to prevent the development of ARV resistance.² Bangsberg demonstrated that these patients were equally or more adherent to treatment compared to patients in resource-rich settings and that treatment cost was the most significant barrier to adherence.^{3,4}

Bangsberg and Martin believed that a strong, well-integrated EMR system would facilitate additional research to improve interventions in resource-limited settings and assure the international donor community that funding ART in Uganda was a sound investment. They also hoped it would build in-country capacity by providing a platform for Ugandans to practice their clinical research skills.

Bangsberg hired Nneka Emenyonu as project director of the MUST-UCSF research collaboration in 2004. Emenyonu recruited a Ugandan to be the data manager, responsible for installing and managing the clinic database. In 2012, database management transitioned to a Ugandan IT professional affiliated with MUST.

Bwana, the physician who had created the ISS Clinic's first medical record in Excel, was the EMR system's most vocal clinician supporter. He had grown up near Mbarara and lost both of his parents to HIV. After completing his five-year medical training and one-year internship at the ISS Clinic in 2002, MUST hired him as the ISS Clinic's first full-time physician. Bwana saw the database's potential to increase efficiency and facilitate research that could be used to improve patient care.

Clinic Director Dr. Winnie Muyindike was enthusiastic about the database's applications for research and patient care. Ultimately employed by and accountable to the MOH, her priorities were to ensure high-quality, well-coordinated service delivery and timely reporting. She needed to balance changes in data collection and management with clinic administration and workflow.

4. Problem

The UCSF research team designed, managed, and was the primary user of the EMR system. Other stakeholders were skeptical of its clinical utility; they sensed it was the university's project and responsibility. Most funding for the Access and OpenMRS databases came from research grants that Bangsberg and Emenyonu secured from American institutions, such as the NIH, UCSF, and the Rockefeller Foundation. Other key contributors included the Antiretroviral Therapy in Lower Income Countries (ART-LINC) Collaboration and WHO (see Fig. 1 for summary of initial OpenMRS implementation costs). ART-LINC enabled the team to hire an additional data manager, a receptionist nurse, a patient tracker, and more data entry and file clerks.

Most local support was supplementary or given in kind. For example, the clinic had access to a MUST professional who helped with IT issues, and Makerere University in Kampala used WHO funding to assign three of its staff to support OpenMRS implementation. Given the newness of OpenMRS and the other demands on IT staff, however, the data manager typically turned to

Funding Source	Amount/Type	Use	Estimated Spending Time Frame
WHO	\$80,000	Equipment: server, uninterruptable power supply (UPS) generator, photocopier, printer, computers, local area network (LAN), laptop, internet bandwidth, antivirus software, desks, chairs, and other office supplies	Early 2007
ART-LINC	\$40,000	Salaries of new full-time data manager, data entry staff, and receptionist nurse	Oct. 1, 2007 – April 30, 2008
Discretionary funds/small research grants	Variable	Unanticipated costs and miscellaneous needs, such as replacing the server when it became infected with a virus and purchasing new antivirus software for clinic computers	Ongoing
Makerere University	Staff support	Portion of 3 Makerere University IT staff members' time to provide implementation support and ongoing technical assistance to ISS Clinic data manager (funding for staff time provided by WHO)	Early 2007

Fig. 1. Estimated costs of OpenMRS implementation at ISS Clinic, 2007–2008. Note: Table does not include limited database maintenance costs covered by UCSF NIH research grant, Sept. 1, 2007–June 30, 2008.

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