An Electronic medical record system to support HIV treatment in rural Haiti

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Background
HIV-AIDS has become the world’s leading infectious cause of adult deaths. Approximately 5% of Haiti’s adult population is infected with HIV, making it the most affected nation in the western hemisphere[1]. The non-governmental organization Zanmi Lasante (ZL) launched an innovative program 5 years ago to treat HIV patients in the very impoverished central plateau with highly active anti-retroviral therapy (HAART)[2]. ZL currently follows more than 4000 HIV-positive patients, over 10% of whom are already on HAART, and was recently awarded funds from the Haitian grant from the Global Fund to Fight AIDS, Tuberculosis and Malaria. Expanding treatment in a region with few doctors and virtually no roads, electricity, or electronic communication is a major challenge requiring careful coordination of clinical care, investigations and drug supplies. We describe a prototype Electronic Medical Record system the “HIV-EMR” to support treatment of HIV and tuberculosis in remote and impoverished areas.

Design Considerations
Treatment of HIV requires daily administration of three anti-retroviral drugs (ARVs) plus supplementary medicines, as well as careful monitoring of clinical progression, side-effects, and laboratory results. HAART is more expensive than other essential drugs and must be given daily to maintain control of the disease and minimize resistance. ZL runs a central clinic housing the laboratory and main warehouse, and 5 smaller clinics at expansion sites in neighboring towns.

To manage a small number of HIV patients requires expertise and access to essential supplies and investigations but it is possible for physicians and staff to know the patients personally. Scaling up to thousands of patients requires much better information management to ensure that patients’ health statuses are monitored effectively, drug supplies are always available at the optimum procurement price and critical laboratory tests are monitored and communicated to physicians even in remote sites. If physicians enter medications online then informatics tools can be used to improve the quality of prescribing by checking dose levels, drug combinations and allergies[3].

The only electronic communication of any sort available in most of our clinical sites are satellite Internet connections set up by ZL. In the main site (Cange) there is a 256 kbs bi-directional link using the USA Teleport Satellite signal. [HH/HL] have established a LAN at the clinic which provides 256 Kbs fractional T1 line Internet connectivity, VoIP Telephony and ISDN and IP Based Videoconferencing. Distant parts of the site are connected by Ethernet or 802.11 wireless LAN. The expansion sites have slower asymmetric satellite Internet connections (400kbs download speed, ~30kbs upload) provided by Telecom Haiti and Skycaster inc. All sites have battery and generator power supplies but outages due to loss of power or lightning strikes are common. The unstable power and difficulty in providing technical support makes it problematic to host servers in the clinics.

These constraints necessitate a system that works over Satellite Internet connections but can also support critical functions such as data entry when there is no connection to the outside world.

Current Progress
We have built a system with three components: (1) A secure, central web-based medical record system that records data on general clinical status, laboratory results, current and previous medications, and follow-up visits. This is based on the technology used for a web-based tuberculosis EMR we have developed in Peru[4]. We use an Oracle database with free software: Linux, Apache web server, and the Tomcat Java Servlet engine, hosted in Boston. Figures 1 and 2 show part of the data entry form and a report. (2) An offline application which allows the entry of clinical data from remote sites when the internet is unavailable, and uploads the data when connectivity is restored. It is configured by HTML/XML descriptor files to replicate the web pages used online, so that new forms can be quickly added and match the design of the web
based EMR. It is built using Java, and data is transmitted to the server as a secure web connection (HTTP with SSL) simplifying the addition of extra forms as required.

(3) A drug inventory system modeled after traditional WHO stock cards, which records stock levels and transactions at different sites. It is accessible via the web, and is linked to patient regimens in the EMR. It displays current inventories in the warehouse and provides warnings if these drop below specified values, as well as analysis of predicted the usage and costs based on the drug regimens.

The EMR allows physicians to order medicines and laboratory tests, and provides alerts based on clinical status and test results. It is operational and patient records are currently being entered.

Future Plans
Over the next five years the project will be scaled up to treat several thousand patients. The offline application is being extended to store up-to-date patient summaries, to allow physicians to review cases when the network is down. Although the system has been developed for clinical care and program management, it is also useful for clinical and operational research. In addition the ability to track the patients in treatment and the resources they require is important in planning project expansion and advising other groups intending to treat HIV in similar areas. We plan to make the HIV-EMR available to other organizations once it is complete, using an open-source model for software distribution.

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References