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Eb@lé-Santé: introducing electronic health records in RDC

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Abstract. *The Eb@lé-Santé EuropAid project (2009-2011) is a partnership between Belgian and Congolese (RDC) institutions. The main aim is to improve health care in RDC via electronic records [4] [5] [7] and educative medical teleconferencing [1]. Therefore we equip four academic hospitals with a server providing medical software, linked workstations in a local area network at the hospital and interconnections to the academic network Eb@le that interconnects seven universities in the country.*
The project also aims at educating local teams towards both technical and medical autonomy.
Currently, the main equipment in the four locations (the university teaching hospitals of Kinshasa, Lubumbashi, Bukavu and Kisangani) is installed and the local teams have started recording medical patient records. The project's methodology aims at solid registration of complete patient records, resulting in high quality data, improving the care of the patient and, enabling swift reporting [10][11] and data-mining for research on anonymized epidemiological data. Moreover, correct and adequate administrative data become available to the hospital management and teleconsulting/tele-education components complete the package.

Keywords: electronic health record, academic network, telemedicine, teleconferencing.

INTRODUCTION

The Eb@é-Santé project was successfully submitted as an “EUROPAid” project in 2008. The project runs for a period of two years and will end September 2011. The goal of Eb@le-Santé is to link up four major hospitals in the Democratic Republic Congo with the respective nearby universities, to install an operational infrastructure (hard- and software) in order to enable systematic recording of patient records, to evaluate these recordings and to study their impact on the functioning of the hospital and on the quality of care. OpenClinic was chosen as the medical record package [2] it has a proven track record in the

region [3] [9] but as far as we know, this is the first coordinated deployment over multiple sites in the Democratic Republic of Congo.

Another goal is to connect the partner hospitals to the international RAFT network [1] [6], originally initiated by Geissbuhler and colleagues from Geneva and now spanning over more than 10 African countries .
RAFT enables international teleconferencing sessions about medical subjects and both on- and off-line multimedia teaching, even when the Internet connection is slow, thanks to the java-based "DUDAL" software.

PROJECT METHODOLOGY

Teamwork and links to "Universitic"

Each partner hospital teams up with its neighboring university, to enable virtual private network access via the university's "Universitic" connection. Universitic is the university backbone project, initiated and conducted by the two Belgian university cooperation bodies: VLIR-UOS and CIUF-CUD.
Universitic aims at deployment of a local institution-wide backbone, with central servers, routers and Internet connections, each suited to the needs of the seven partner universities of VLIR and CIUF in RDC, amongst which the four Eb@le-Santé partners: UNIKIN (Université de Kinshasa), UNILU (Université de Lubumbashi), UCB (Université Catholique de Bukavu) and UNIKIS (Université de Kisangani).

One originality of Eb@le-Santé, is the "piggy-backing" on the deployment of the Universitic project. This enables us to capitalize on the deployment realized with and by the universities, while enriching this with medical applications.

At the start of the project, the general methodology, described below was agreed upon with the four partners, but specific choices were made by the local groups, in agreement with the priorities of the participating hospitals concerning the registration modalities of patients and the selection of the medical departments to be involved as of the start.

Hardware deployment

The project provides to each partner hospital (via its university) the following hardware components

- no-break installation comprising batteries and no-break group enabling 24 hours autonomy in case of mains interruptions
- a server machine
- 20 laptop workstations (being deployed in the hospital departments) running open source software
- wireless base stations near the workstations in the hospital with maximum security and access restrictions
- router to interconnect wireless stations and server.

For the server machines, special attention was paid to the power consumption (max 250W) of the servers as this has an immediate impact on the sizing of the no-break group and batteries / autonomy in case of power failure. As endpoint workstations, "thin client" machines are most appropriate, but the selection between thin-clients and laptop PC's was left to the local teams, to comply with their vision and previously installed base.

Preference was given to a set of wireless stations, linked to a central switch to interconnect the departmental workstations to the OpenClinic server. Thus reducing drastically the number of cables to be installed, allowing more flexibility in the deployment and increasing reliability, as cables only run over ceilings and in cable guides, beyond the normal reach of clinical or logistic personnel and cleaning teams. On figure 1, this standard set-up is depicted.

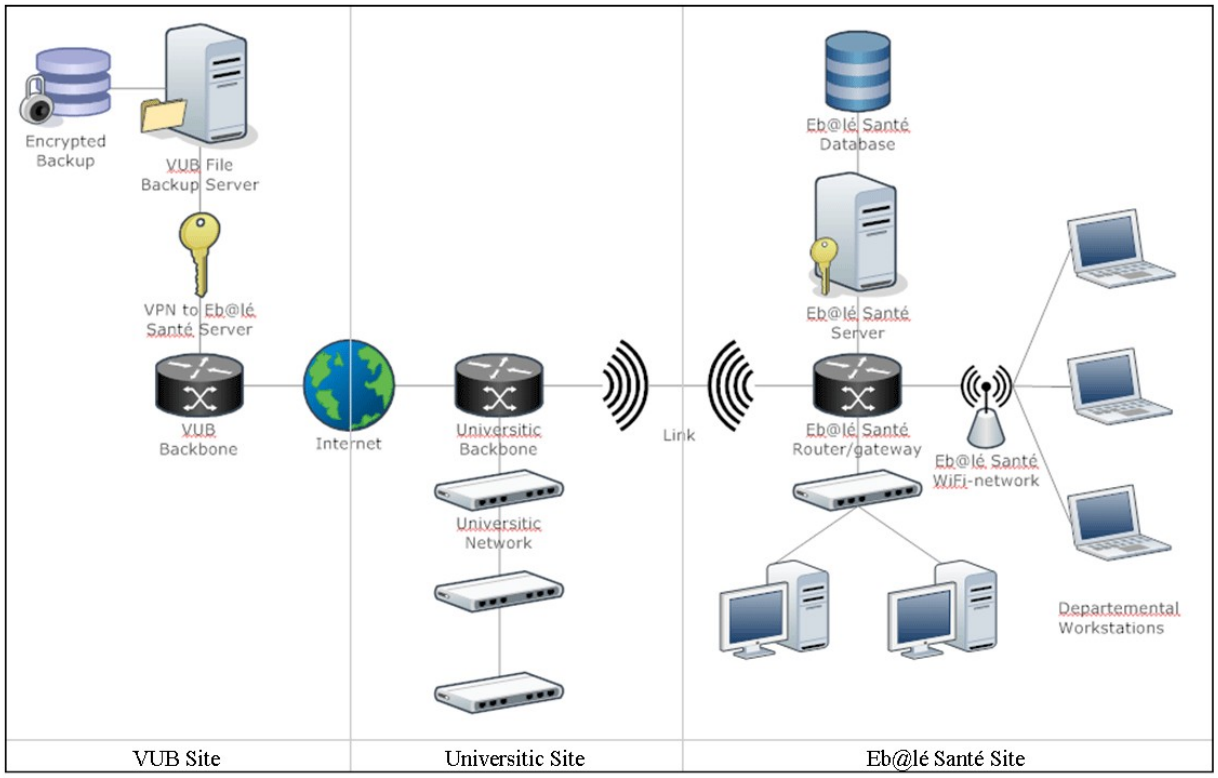

Figure 1: set-up of an Eb@lé Santé site next to an UNIVERSITIC site

The Universitic backbone offers the "off-the-shelf" connectivity to the seven Universitic sites in the major universities higher education institutes in RDC and allows for specific purpose Internet connections: link to RAFT and support from a distance (Belgium) over a virtual private network. Software and configuration adjustments, requiring otherwise very expensive displacements by experts now can be realized in the evenings from a distance.

Software deployment

As a basis for the installation, stable Linux distributions (Debian) are recommended for the operating system of the server machines. For client machines, Linux-based (Ubuntu) laptops offer both the strength of being relatively resistant to (short) power interruptions and they are less prone to viruses. Disk-less thin clients are another possibility.

Several hospital information management systems have been evaluated for the purpose of the project and finally the OpenClinic open source software was selected for deployment in the eb@lé-santé project. The

OpenClinic standard software package has been customized for the RDC hospital environment and was installed on the server in all 4 sites. MySQL has been chosen as a back-end database server.

For the purpose of the project, it has been decided to limit the scope of implementation to a number of hospital departements:

Location	Hospital size (#beds)	University	Priority Departments
Kinshasa	CUK 800	UNIKIN	Admin, Statistics, Lab
Lubumbashi	CUL 500	UNILU	Admin, Statistics, Pediatrics
Kisangani	CUKIS 400	UNIKIS	Admin, Statistics, Internal Medicine
Bukavu	HPGRB 350	UCB	Admin, Statistics, Internal Medicine

Table 1: Project overview

For any of the selected hospital departments, existing business procedures, reports and documents were collected and analyzed, in order to adapt the OpenClinic software to perfectly match the functional needs of these departments. Based on these analyses, the following OpenClinic modules have been re-engineered:

- Patient administration
- Financial management and care delivery data entry
- Reason for encounter registration
- Patient discharge diagnosis management
- Clinical data entry screens for pediatrics and internal medicine departments
- Work list based lab order entry and results management
- Clinical statistics and activity reporting [10]

Finally, a number of OpenClinic data structures have been adapted to match aspects that are specific to every site (available hospital departments, available lab analyses, care deliveries and their prices, local health insurance contracts…).

Following patient data are recorded:

- administrative data (identity, admissions, discharge, fees)
- medical contacts during the stay (exams, treatments, …)
- discharge diagnoses
- patients' evolution

OpenClinic accords special attention to correct patient identification, so that on re-admission, the correct patient is recovered along with his history, avoiding multiple recordings for a single person and leading to better care as the history of the patient is immediately available to the treating physician.

Diagnoses are recorded in ICPC and ICD [8], via the three-way thesaurus developed in Belgium. The encoder is presented a hierarchical pick-list, guiding him towards the adequate level of detail.

When correct patient recording is performed, the hospital's statistics generation and reporting to higher instances becomes straightforward [10][11].

Training

Based on the customized OpenClinic software deployments, several kinds of training were organized:

1. System administrator training was provided on every site to the local ICT staff
2. User training was set up in Kinshasa and Bukavu (an average of 20 attendees has been registered), serving also users from the other sites in Lubumbashi and Kisangani:
    - Administrative user training
    - Clinical encoder training
    - Financial user training
    - Clinical user training

These intensive training programs have proven to be extremely important before putting the hospital information management system into production. In order to offer permanent training possibilities to the already trained users as well as to future hospital staff, an OpenClinic test-environment has also been set up at every site, enabling new users to get acquainted with OpenClinic electronic health records, while not "endangering" real clinical data during their apprenticeship. On the "test site", every page is explicitly marked as such, in order to avoid any confusion.
For each institution, a local responsible has been designated, in accordance with the top management of the hospital; then a number of medical, paramedical and technical persons have been selected and trained.
During the training sessions, attention was given to the "main picture" so that everyone can clearly identify his or her role in the whole process.

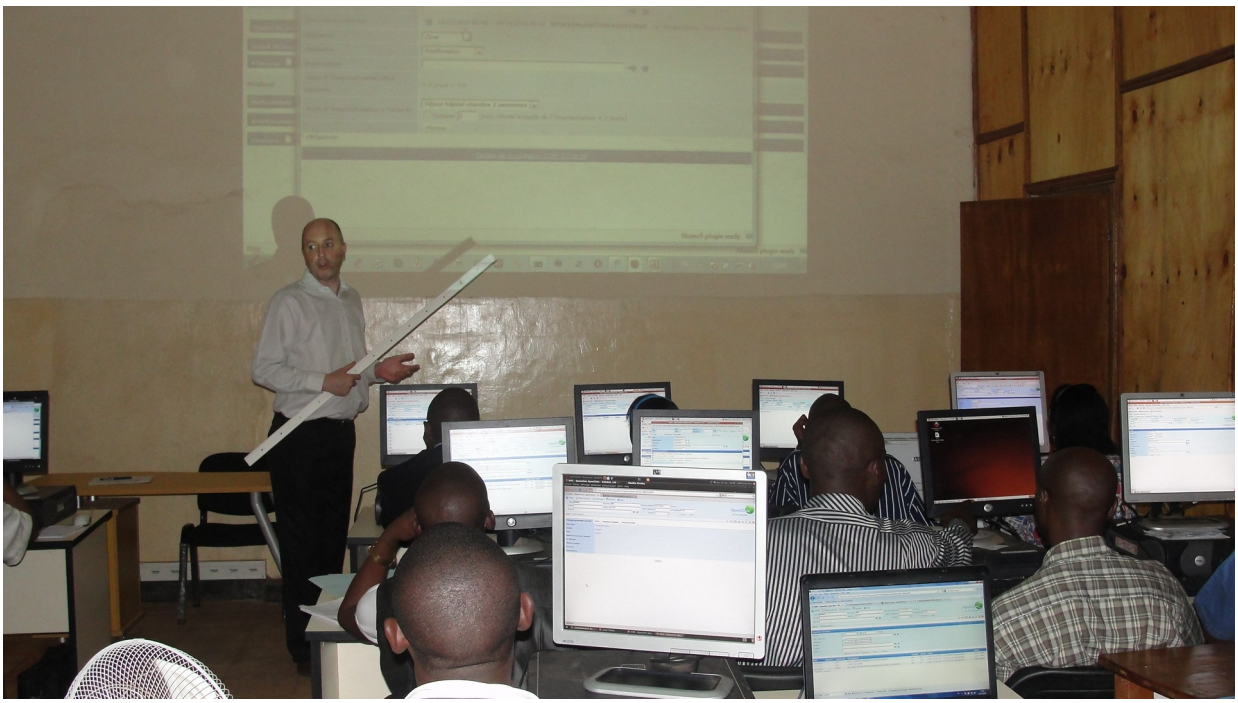

Figure 2: ICT and health informatics training sessions are an essential part of the project! Co-author Frank Verbeke introduces OpenClinic

Teamwork and information sharing

To share information on developments in the project among all partners, a blog is updated regularly at www.ebalesante.net .Mailing lists are created for different groups and allow discussion on various topics related to the project. Finally, a project follow-up procedure was initiated, requiring the local clinical responsibles to report about the progress on their site via standardized forms.

INTERMEDIATE RESULTS

Currently, just past the mid-term of the project, patient-centered data entry has started on all 4 sites. Clearly, some sites have been faster than others in adopting the essential registration procedures being:

- Patient identification
- ADT (Admission, Discharge, Transfer) management
- Reason for encounter registration
- Discharge diagnosis registration

3 weeks after training was provided, some 1.000 patients have been registered into the OpenClinic system. If the actual pace is sustained, we can expect to have between 20.000 and 25.000 patient records registered into the system by the end of the project.

These datasets will be analyzed by the local teams in order to:

- evaluate hospitalization costs
- make diagnosis dependent comparisons
- make bi-morbidity studies about the most frequent illnesses.

Follow-up training and coaching session have been scheduled for all 4 sites in March 2011. The aim of these sessions will be to extend and improve existing registration routines and to provide feedback on what has been achieved during the first trimester.

CONCLUSIONS

After just over one year, the EuropAid project "Eb@le-sante" is on track: the hardware is installed on the four sites, the local teams all got their technical, medical and administrative training and data collection has started in the form of patient registrations and patient records.

The security procedures are in place and in operation. RAFT connectivity and training still requires attention, this will be realized in the first months of 2011.
Distance support is effectively performed from Belgium as well as a nightly secured back-up from the four participating sites in RDC.

During 2011, we hope to be able to make sufficient recordings in order to demonstrate the feasibility and the advantages, both organizational and medical for the project partners. Moreover , this will enable us to perform epidemiological and co-morbidity studies in RDC, for the first time, based on standard electronic clinical records.

Reporting on the hospital level, towards the Ministry of health will be activated as soon as the number of recordings becomes representative. We hope that by the end of the project in September 2011, all incoming- and outgoing patients will be recorded in the four sites.

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