A model for a Regional Health Information Network sharing clinical information between professionals in Brittany

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Abstract: The purpose of this paper is to present a generic model of information system supporting healthcare networks for health professionals in Brittany. This model is aimed to develop cooperation between hospital professionals, primary care and practitioners whatever the specific pathology, by providing tools for exchanging and sharing medical-related data. The model is designed based on the heterogeneity factors revealed by a prospective survey. It includes secured exchange of nominative medical data, all other information and activities being accessible by a Web portal. Other associated tools are a synchronous collaborative platform, and a e-learning module. The first implementation, currently in use by the professionals, is presented for the existing neurology healthcare networks.

Keywords : Health information network, shared medical data, e-health, data integrity and security

Introduction

Over the past ten years, France policy in the Health sector has been to encourage the development of healthcare networks and to decentralize the health management to the regional level. Healthcare networks are aimed to improve the quality of both health care delivery and health outcomes [1]. Indeed, formalizing networks and recognizing their potential for delivering better health care is nowadays recognized as a new paradigm in the health sector [2]. In this context, it was innovative in Brittany (Western region of France) to start a first experiment of health information networks focusing on the treatment of chronic neurological diseases: the NeuroBretagne Project [3]. The project’s goal is to develop a network for patients suffering from chronic and handicapping neurological diseases such as Multiple sclerosis, Parkinson disease and amyotrophic lateral sclerosis. From the outset, the managers of health networks authorities have foreseen the advantages of a shared and common information system. Indeed, network efficiency depends on how information is managed. A recent study carried out in the US [4] has shown that preventable medical errors occur with alarming frequency in the US Healthcare system: over 10,000 deaths per
year are due to withheld information and bad information flow. Today, health professionals use conventional means of communication such as Phone, Fax, and mail, none of which being legally or technically secure. Let note for instance that the fax which is widely used is neither legally bound nor secured. In fact, the HAS organization (French High Health Authority Agency) considers its use for medical data transmission as strongly inadvisable. Information and Communication Technologies (ICT) can make these exchanges easier and more secure. As medical information is nowadays increasingly available in digital format, it should be accessible and shared among professionals as well as between professionals and patients. This paper describes a generic model of a Regional Health Information Network. The model must be adaptable to any type of healthcare networks and professional systems, in accordance with model standards. We stress the need of consistency over four axes: the user’s needs, computer equipment, software and medical systems interoperability. It also presents the model and its specificities. Then the first implementation of the proposed model applied to Neurology is described. Note that a second implementation is underway for perinatology, while an oncology network is being implemented in the district of Rennes.

1. Material and methods

Several existing regional healthcare networks in Brittany have been considered. Such networks include health professionals from University hospitals and private clinics, as well as private-sector specialists and general practitioners. They are aimed to bring together all Brittany health professionals for specific medical domains or pathologies. Networks in neurology, cancerology and perinatology contacted the Medical Informatics Laboratory of Rennes University for designing a Regional Health Information Network, aimed at facilitating their everyday patient-related work. First, a prospective survey was conducted by interviewing all healthcare professionals involved in the NeuroBretagne project [3]. The survey questions were intended to understand their work habits, office work environment, computer equipment and computer skills. An additional question related to the functional needs they would like to be implemented in the future computer network. The survey data were then analyzed, leading to the identification of network design issues, the most important being heterogeneity. A general framework was defined to manage the heterogeneity factors. A generic model of the information system was set up for the health information network. The information system was modeled using UML based on the whole set of collected information. Finally the model was implemented for neurology using dynamic web technologies (LAMP: Linux, Apache, MySQL, PHP), and Open source software (SPIP based on CMS (content manager system)).

2. Results

Heterogeneity factors: The survey, conducted in 2004 [3], reveals noticeable heterogeneity. The first result shows the large diversity in the classes of health
professionals (such as specialists, GP, nurses), as well as in their working places (e.g. hospitals, clinics, medical offices). Their functional needs are different although they all need to share patient-related data. Some of these needs must comply with the legal and administrative requirements on security, confidentiality and rights for patients to access their health records. Healthcare network organizations can vary depending on the medical domain (e.g. chronic pathology vs. acute pathology). Large diversity appears in computer equipments (hardware and software), in the nature and size of existing information systems (e.g. Hospitals vs. medical offices), and in the interoperability between information systems. Computer skills of health professionals as well as their software use also vary a lot (e.g. a large number of professionals use unsecured email to exchange with colleagues while very few take advantage of available medical software functionalities).

The proposed model of an information system for healthcare network:

**Organization analysis:** A typical patient path within the existing NeuroBretagne network is as follows: Most of the time, a general practitioner has identified the early symptoms of the disease. He refers his patient to a neurology specialist.

Once this specialist has confirmed the diagnosis, he refers the patient to the hospital, where a complete check-up is carried out. Diagnosis and therapeutic strategies are usually decided by a multidisciplinary staff. This staff identifies appropriate participants for clinical trials. Patients are also advised to join associations to meet other patients. Health professionals in NeuroBretagne use paper (postal mail or fax) to communicate with each other. Exchanged documents are mainly appointment requests, hospital reports, and medical records. They can also be survey questionnaires, clinical trial documents. Both public and private practitioners take an active part in the clinic activity. This patients’ management is in fact generalized to any pathology, non-neurological included. It is applicable to other networks. Therefore the proposed information system is strongly based on this organization model.

**Information system modeling:** Based on these analyses, the more important criteria to take into account in our model is security [5]. Indeed all medical nominative patient data must be transmitted in a secured way. These data will be exchanged asynchronously using secured email (SE). When professionals need to exchange information in real time (synchronous modality) to share their expert opinion, they can use for example a synchronous collaborative platform (S-CSP) in the secured mode. Sharing medical patient data can be typically resolved by adopting the Sharable Electronic Health Record (SEHR).

All other information is shared and accessible through a web-based portal (WP). Obviously, conventional email (E) and S-CSP can also be used for exchanging non critical information (e.g. for e-learning activities). Finally, a final axis is considered which represents the interoperability level requirements between information systems (Table 1).

**Secured email system:** As e-mail was widely used, we wanted to build the information system on already acquired skills while respecting current legislation. We chose the CPSURE solution (edited by Enovacom™ [6] and approved by the French Professional Health Card - Public Interest Group. This system is a web mail service, unlike the other
secured e-mail solution which uses fat clients. The web mail module uses widespread open source software (IMP-HORDE) [7]. E-mails encryption and signature are generated by a Java applet and use the Professional Health Card process. This process is based on the Asymmetric Public-key techniques [8] [9]. Thus, this ubiquitous solution allows sending and receiving secured e-mails with the use of a web-browser only.

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**Table 1: Information system model**

**Web portal:** The portal structure (Figure 1) contains three access levels. Level 1 is the only one accessible by the general public. It contains general information on the existing professional networks and redirects people to patients associations or support groups. Only members of the networks can access Levels 2 and 3. Level 2 provides information on professionals and activities (e.g. members’ directory, schedule, pedagogical resources). Let us note that the portal can be easily managed by members and it doesn’t require any specific computer skills. Level 3 connects to the professional web page of a thematic network. Each existing network has its own web publishing space while benefiting from a single CMS. At this level are found specific information of each thematic network: diagnosis or therapeutic guidelines, clinical trials, clinical training, epidemiological surveys, chat room, forum, mailing list etc. When some information is likely to be of interest to everyone, this information can be automatically published into an upper-level.

**An implementation in Neurology:** The proposed model has been implemented for neurology in Brittany and is currently used by neurologist professionals. In this section, selected features of the implementation are presented.

**Access rights management module:** Access rights to network contents can be specified. Thus, it is possible to personalize the information according to the user’s profile. If a registered member is involved in a specific thematic network, he/she accesses the information of this network by default. However he/she keeps the possibility of surfing on other networks.

**The structure inheritance function:** The purpose of the model is to pool thematic networks into the same structure. The information system must be able to integrate new networks
easily and quickly. The structure inheritance function permits a network template to be reused for another one. In addition, this function allows publishing information automatically from one level to another.

**E-learning module:** This module answers to the continuing medical education needs. It implements the Script Concordance Test [10] well adapted to get experts opinions on clinical cases as well as to provide a means for professionals to test their competence.

**Synchronous collaborative platform:** This module will be used by professionals for teleconsultation. The BREEZE collaborative platform (Macromedia) was chosen. Medical information is exchanged in synchronous mode with a high security level.

3. Discussion

The first implementation of the system has been validated by all the professionals involved (i.e. neurologists and physical therapists). The main wish of the professionals was a single and user friendly interface. Light tools were developed in order to minimize installation problems considering the large heterogeneity of computer equipments. Our system was
chosen not to interact with medical software; it consists of a web system for the sharing and exchange of data. We did not want to set up a shared medical record for two main reasons: technical, organizational, legal, and ethical issues, and the current implementation of the French National Medical Shared Record. The system has some limits. When a user receives a document by e-mail, the attached file cannot be automatically integrated in the Electronic Health Record of the information system. This is due to the lack of interoperability between information systems.

Furthermore, our system does not put any constraint on the modalities of exchanges between users (procedures, controls). Sequences of the exchanges are often the same and can be modelled in a workflow [11]. Using a workflow can be very useful (it offers traceability, efficiency, clarity) provided that few exchange sequences exceptions are made. However, this kind of approach can make the information system much heavier to use.

4. Conclusion

Web technologies provide an attractive infrastructure for efficient and low cost communications in regional health information networks. The proposed information system is based on the principle of sharing and exchanging information between professionals. Patient’s health information is protected and exchanged. The other kinds of information are widely shared and accessible on a web portal. We succeeded in setting up a simple system that can be instantiated in several specialties, considering the limited computer skills of the professionals. We have taken into account the heterogeneity of the computer equipment. Filling the gap with the setting up of national electronic health record, this system already supports and improves information exchanges between professionals and facilitates input in a health network

References