Chapter 4

Electronic Health Records System Using HL7 and DICOM in Ophthalmology

Isabel de la Torre Díez
University of Valladolid, Spain

Roberto Hornero Sánchez
University of Valladolid, Spain

Miguel López Coronado
University of Valladolid, Spain

María Isabel López Gálvez
University of Valladolid, Spain

ABSTRACT

Health Level Seven (HL7) and Digital Imaging and Communications in Medicine (DICOM) standards are strongly influencing Electronic Health Records (EHRs) standardization. In this chapter, we present a web-based application, TeleOftalWeb 3.2, to store and exchange EHRs in ophthalmology by using HL7 Clinical Document Architecture (CDA) and DICOM standards. EHRs are stored in the native Extensible Markup Language (XML) database, dbXML 2.0. Application architecture is triple-layered with two database servers (MySQL 5.0 and dbXML) and one application server (Tomcat 5.5.9). Physicians can access and retrieve patient medical information and all types of medical images through web browsers. For security, all data transmissions are carried over encrypted Internet connections such as the Secure Sockets Layer (SSL) and Hypertext Transfer Protocol over SSL (HTTPS). The application verifies the standards related to privacy and confidentiality. The application is being tested by physicians from the University Institute of Applied Ophthalmobiology (IOBA), Spain.

INTRODUCTION

Telemedicine is a general concept that includes diagnoses, examinations, medical meetings, collaborative operations and nurseries (Xiang et al, 2003). It uses common technologies that provide a conduit for information exchange between physicians, nurses and patients (Kugean, 2002). There are many different disciplines in telemedicine, such as teleradiology, telemonitoring, teleconsultation, teleconference, teleophthalmology and telepsychiatry (Brauer, 1992). Teleophthalmology is the use of information and communications technology to enable the delivery of ophthalmology services between geographically separated individuals (Health Canada, 2007). Some teleophthalmology objectives are: to make eye care service accessible and affordable by reducing travel cost and for the patients, to enable people in remote areas to have access to specialised eyecare facilities and to act as an interface between physicians to share their experiences. Teleophthalmology is highly suitable for treating speciality diseases like Glaucoma, Diabetic Retinopathy (RD) and Corneal Ulcer. Since all these diseases can be diagnosed by looking at the fundus image, a digital fundus camera attached to a computer and supporting software alone is required in treating these diseases (Thulasi et al, 2007).

Information systems in telemedicine provide storage, retrieval, connection, and evaluation of the healthcare information. Some of these systems are the Electronic Patient Records (EPRs) and the Electronic Health Records (EHRs). EPR stores and administrates all the medical data about a patient (Horsch & Balbach, 1999). EHR is a secure, real-time, point-of-care and patient-centric information resource for physicians (HIMSS, 2003). EHR usually contains, without being limited to, observations, care plans, comments, and, as a whole, act as a long-term accumulator of information about what has happened to the patient. The term EPR focuses only on relevant information for specific medical problem episodes. EHR must enable the communication of healthcare information to support shared patient care, improved quality of care and effective resource utilisation (Ferreira et al, 2004). Some benefits of the EHR systems are their universal access, coding efficiency and efficacy, easier and quicker navigation through the patient record (Smith & Newell, 2002). There are several barriers to their adoption such as training, costs, complexity and the lack of a national standard for interoperability (Gans et al, 2006).

The telemedicine applications and services often involve many institutions using different systems and technologies. This complicates the necessary technical standardization (Holle & Zahlmann, 1999). International, European and national organizations are concerned with standardization of EHR such as the ISO Health Informatics Standards Technical Committee (ISO/TC) 215, CEN Technical Committee (CEN/TC) 251, openEHR, Health Level 7 (HL7), Extensible Markup Language (XML), Integrating the Healthcare Enterprise (IHE), Digital Imaging and Communication in Medicine (DICOM), American National Standards Institute (ANSI) to name but a few (Bott, 2004).

DICOM is a standard that is being used for the exchange and storage of medical images and related information all over the world. This format has been recognized as the de facto standard for storage, transferring and sharing of cardiac images along different modalities like magnetic resonance imaging (MRI), nuclear medicine, computer tomography (CT), digital angiography (XA), digital radiology (Marcheschi et al, 2003). One of the advantages of DICOM is that only a part of the defined keys is specified (Neri et al, 1998). After radiology, ophthalmology is one of the biggest users of digital imaging and therefore DICOM is likely to be a significant development in the future for ophthalmic imaging. In turn, HL7 is dedicated to the development of standards for the message-oriented exchange of information between health information systems. The idea of using the same mechanism for the specification

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