Benefits and problems in implementation for integrated medical information system

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ABSTRACT

Purpose : Once the decision has been made to adopt an integrated medical information system (IMIS), there are a number of issues to overcome. Users need to be aware of the impact the change will make on end users and be prepared to address issues that arise before they become problems. The purpose of this study is to investigate the benefits and unexpected problems encountered in the implementation of IMIS and to determine a useful framework for IMIS.

Materials and Methods : The Yonsei University Dental Hospital is steadily constructing an IMIS. The vendor's PACS software, Piview STAR, supports transactions between workstations that are approved to integrating the healthcare enterprise (IHE) with security function. It is necessary to develop an excellent framework that is good for the patient, healthcare provider and information system vendors, in an expert, efficient, and cost-effective manner.

Results : The problems encountered with IMIS implementation were high initial investments, delay of EMR enforcement, underdevelopment of digital radiographic appliances and software and insufficient educational training for users.

Conclusions : The clinical environments of dental IMIS is some different from the medical situation. The best way to overcome these differences is to establish a gold standard of dental IMIS integration, which estimates the cost payback. The IHE and its technical framework are good for the patient, the healthcare provider and all information systems vendors. ***(Korean J Oral Maxillofac Radiol 2005; 35 : 185-90)***

KEY WORDS : Hospital Information Systems

Introduction

The Integrated Medical Information System (IMIS) consists the Order Communication System (OCS), Electronic Medical Record (EMR), Picture Archiving and Communication System (PACS), Laboratory Information System (LIS), Electronic Data Interface (EDI) and Hospital Information System (HIS).

The ultimate responsibility of the radiologist is to provide the highest possible quality of care for patients and to provide prompt, reliable, and responsible consultation for clinical colleagues as cost-effectively as possible. Users need to be aware of the impact the change will make on end users and be prepared to address issues that arise before they become problems. Once the decision has been made to adopt IMIS, there are a number of issues to be overcome. This study considers the benefits and unexpected problems encountered in the implementation of IMIS.

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Materials and Methods

The Yonsei University Dental Hospital is steadily constructing an IMIS. Our hospital has 258 unit chairs, which need 281 workstations. The estimated total data flow per year was 1.12 TB/year in 2004. The vendor's PACS software was Piview STAR, which is a Windows 98/NT/2000/XP-based Digital Imaging and Communications in Medicine (DICOM) view station, adapted for storing, processing and report generating (Fig. 1). Piview STAR supports transaction between workstations that are approved to IHE with security function. Piview STAR is either a stand-alone DICOM workstation or an integral component of INFINITT's complete STARPACS solution. Piview STAR fully supports the DICOM standard, including DICOM store, DICOM query/retrieve, and DICOM print and allows local management of INFINITT's powerful

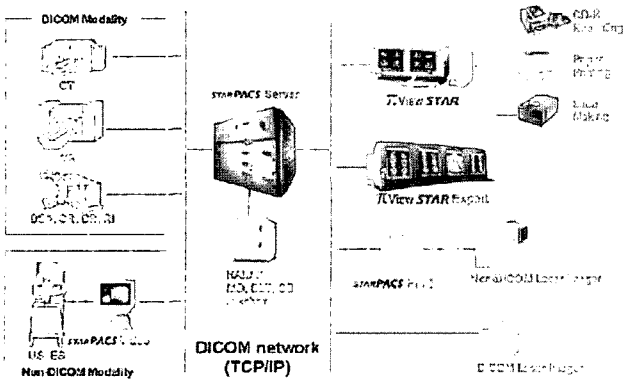

Fig. 1. STARPACS Components.

database functions.

Results

Piview STAR and Piview STAR Expert fully features single or dual-monitor diagnostic and clinical display with access to the central DICOM server and local database. Piview STAR Expert is the extended version of Piview STAR, with diagnostic feature applicable to large medical centers and university hospitals. Piview STAR Expert can support up to four high-resolution 2K monitors simultaneously and support advanced hanging protocols for efficient utilization of four monitors. It also includes functions for work lists, and voice reporting for increase efficiency. Piview STAR supports transaction between workstations, which are approved to IHE with security function.

STARPACS server is composed of the database server, hierarchical large capacity file server, network infrastructure, DICOM input and output system, and image information is stored using various compression methods and the hierarchical data management concept provides a highly cost effective storage system.

STARPACS Video (VideoLink) is a video acquisition gateway that converts the acquired images from non-DICOM modalities such as intra-oral radiography, panoramic radiography and TMJ radiography to DICOM images and transmits them to the DICOM server.

It is generally acknowledged that IMIS has economical, clinical and strategic business benefits. The vendor's developed PACS was able to manage images from a range of digital modalities each providing its own image data format. However, some obstacles that were encountered in the implementation for dental IMIS were high initial investments, delay of EMR enforcement, underdevelopment of digital radiographic appliances and software and the vendor's low interest in the dental field.

Discussion

1. Benefits of IMIS implementation

The benefits of IMIS were improved medical examination and treatment and patient service, specialized business and hospital management, rapid and correct information transmission for study and education, and increased hospital publicity.

In a film-based world, radiologists by virtue of their training and experience have a very good understanding of the physical processes required to provide accurate, high quality, radiologic images and interpretations. In shifting to an electronic paradigm of radiology, radiologists must now understand, at least at a high level, the new information model and work flows that surround them, occasionally without a physical experience.

2. Various problems of IMIS implementation

The various problems encountered with IMIS implementation were high initial investment, delay of EMR enforcement, underdevelopment of digital radiographic appliances and software and insufficient educational training for users. Because of the extra complications of dental practice, the initial investment for dental PACS is generally much more than that of medical PACS.[1] Cost-justification is the most important issue to dental hospital administrators when purchasing a PACS. Fortunately, health insurance reimbursement to dental PACS commenced in Korea in February 2004, but the ever-present possibility of this reimbursement to PACS being cut gives concern to dental hospital administrators.

The image quality of digital sensors almost reaches the level of film-based image quality, but the rigidity and volume of the intra-oral digital sensor causes patient inconvenience and discomfort (Fig. 2).[1] The production of a more flexible and stable sensor holder is necessary to reduce patient inconvenience.

3. An excellent framework for IMIS

The clinical environment of dental IMIS is somewhat different from medical situation. The best way to overcome these differences is to establish a gold standard of dental IMIS integration, which estimates the cost payback. Clear technical communication between the customer and the supplier before both sides are committed is critical to its success. It is neces-

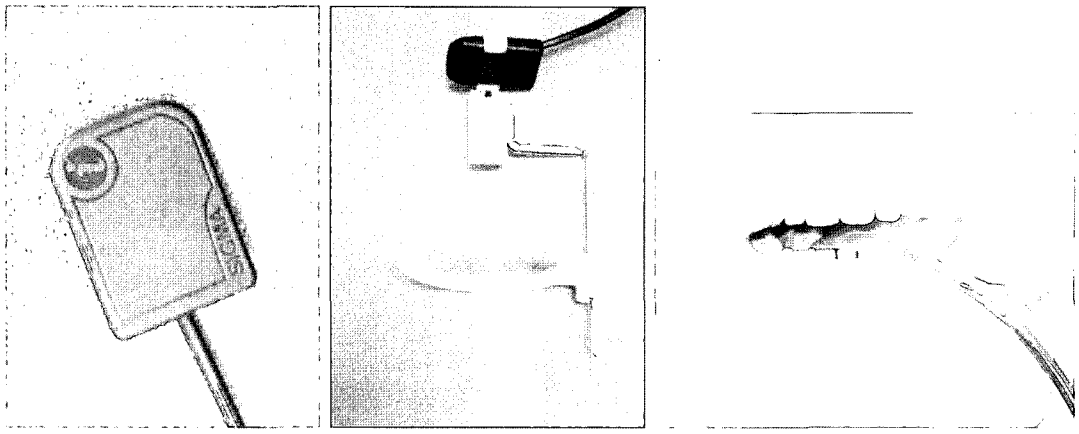

Fig. 2. Intra-Oral Digital Sensor.

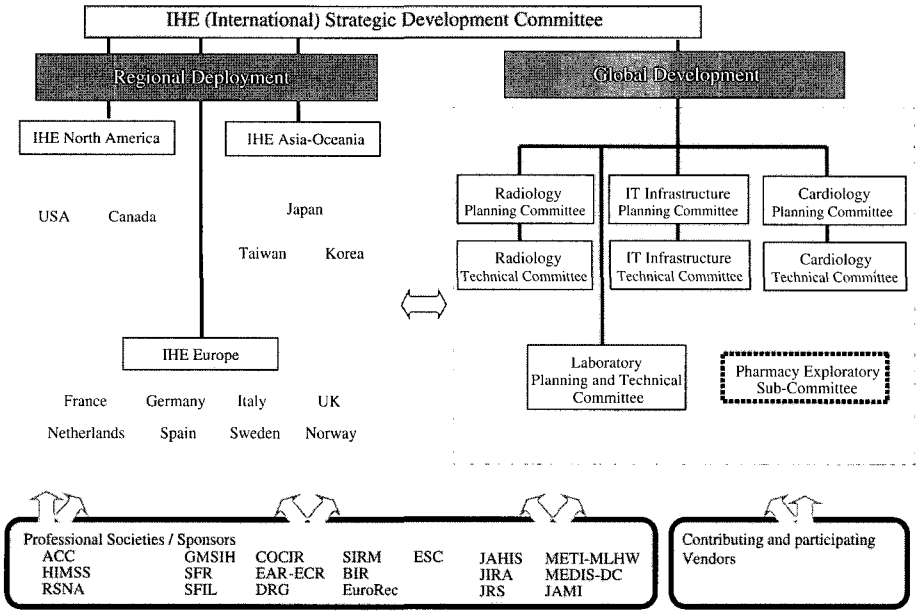

Fig. 3. IHE Organization Structure.

sary to develop an excellent framework that is good for the patient, healthcare provider and information system vendors, in an expert, efficient, and cost-effective manner.

Integrating software applications in IHE is a challenge that requires discussion and negotiation between the users and the vendors selected to provide systems. The IHE technical framework provides an important set of definitions and workflow patterns that can be used to jump-start these negotiations. If the representatives of IHE and vendors agree to use the definitions and work flow defined in the framework, then a large number of integration questions and specifications are already documented and do not need to be renegotiated and documented again by both parties. IHE is not a standard.[2-7] It is an initiative that has produced a consensus document that serves as a technical framework within which medical information systems can be designed to interact successfully to accomplish real-world tasks. IHE uses existing standards as tools to achieve integration. Today, these tools are DICOM and Health level 7 (HL7), which are sufficient for the tasks described in the current IHE integration profiles. As more integration profiles and tasks are defined in other areas, other standards will be added as necessary.[5]

IHE has developed strong support internationally, as well (Fig. 3). In Europe, IHE has been organized under the sponsorship of the European Association of Radiology (EAR) and the medical imaging industry. Similarly, the Korean Society of PACS and the Korean Radiological Society have sponsored IHE-Korea.

From the perspective of practical value to the user, the most important output of the IHE initiative is the technical frame-

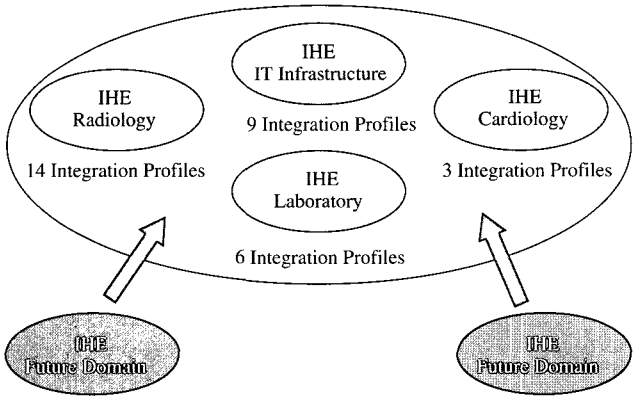

Fig. 4. IHE Technical Frameworks.

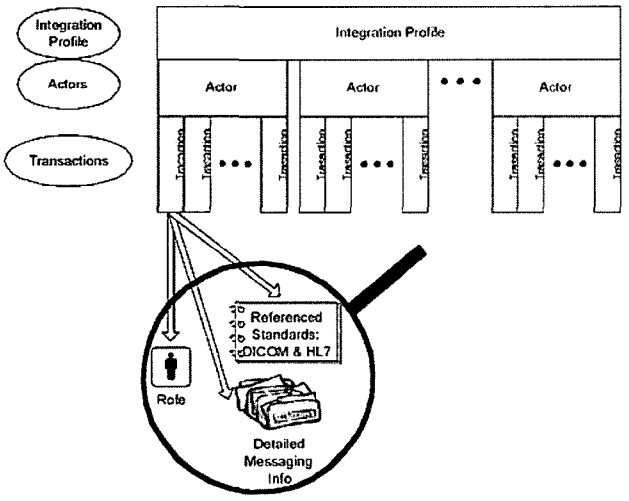

Fig. 5. Organization of information in the IHE Technical framework.

work. This document describes, as unambiguously as possible, the transactions that must occur to solve seven real-world problems, or integration profiles in IHE terms.[5] The IHE technical framework is a detailed, rigorously organized document that provides a comprehensive guide to implementing the defined integration capabilities (Fig. 4). The technical framework serves as a consensus document of how to think about, discuss, and successfully overcome medical information system integration problems by using existing standards and tools.[5] Finally the IHE technical framework imposes some requirements on the end users. The framework defines a particular workflow model, and the messages exchanged by systems reflect that model. Users will benefit only if they are committed to change their current workflow to match that defined in the framework. Such conformity will allow the user to request a standard software solution from multiple vendors rather than asking each vendor to customize software to match the workflow in the enterprise.

IHE integration profiles organize sets of the IHE actors and transactions in order to address specific patient care needs. Integration profiles offer a convenient way for vendors and users to reference the functionality defined in the IHE technical framework without having to restate all of the detail regarding IHE actors and transactions (Fig. 5). They describe clinical information and workflow needs and specify the actors and transactions required to address them.

The technical Framework delineates standards-based transactions among systems (generically defined as IHE actors) required to support specific workflow and integration capabilities. Information systems or applications that produce, manage or act on information are represented as functional units called IHE actors. Each actor supports a specific set of IHE transactions. A given information system may support one or more IHE actors. Transactions are exchanges of information between actors using messages based on established standards (such as HL7, DICOM and W3C). Each transaction is defined with reference to a specific standard and additional detailed information, including use cases. This is done to add greater specificity and ensure a higher level of interoperability between systems.

IHE thus far defined integration profiles for the following clinical needs in radiology: Scheduled Workflow, Patient Information Reconciliation, Consistent Presentation of Images, Presentation of Grouped Procedures, Post-processing Workflow, Reporting Workflow, Evidence Documents, Key Image Note, Simple Image and Numeric reports, Charge Posting, Basic Security and Access to radiology Information (Fig. 6).

Scheduled Workflow defines the flow of information for the key steps in a typical patient-imaging encounter (registration, ordering, scheduling, acquisition, distribution and storage) (Fig. 7). The IHE Scheduled Workflow integration profile describes a communication and workflow environment that provides benefits for radiology departments who want to standardize system software.[8] The Modality Work list is a key component of the Scheduled Workflow integration profile that allows an operator at each modality in the department to retrieve a list of scheduled procedure steps to perform and to automate the process of entering the correct patient identification information in all the images created with the modality.[8]

Clinicians and administrators should be aware of the clinical and operational benefits that can be realized through the IHE integration profiles and encourage their departments

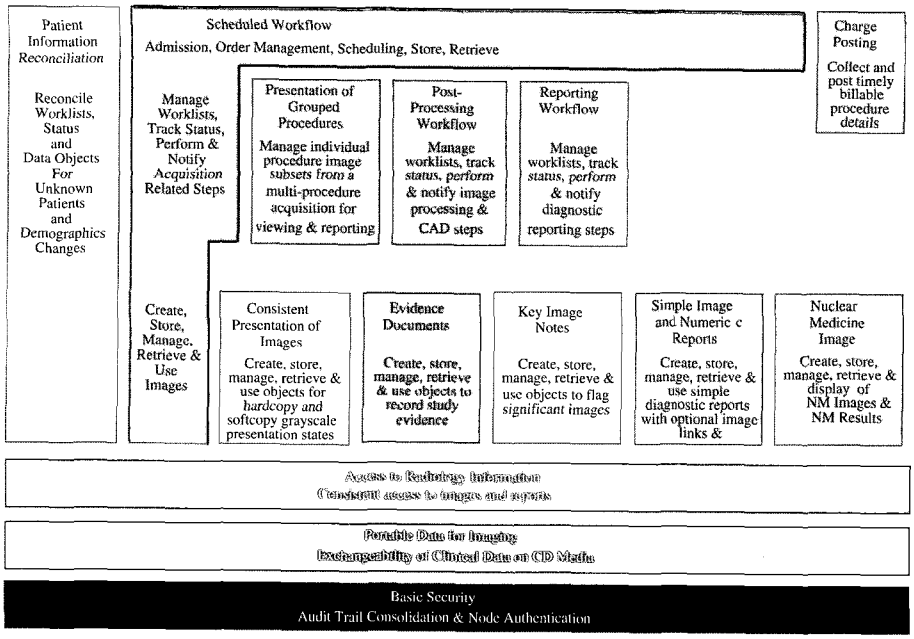

Fig. 6. IHE Integration Profiles in Radiology.

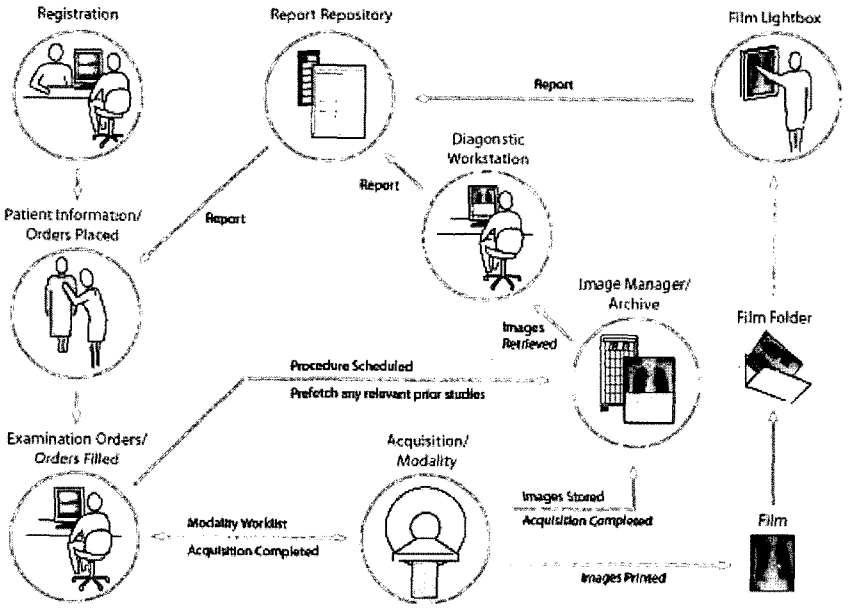

Fig. 7. Scheduled Workflow.

to demand those capabilities when acquiring or upgrading systems. Information technology professionals should know how to use IHE integration profiles in request of proposals (RFPs) and purchasing agreements and should familiarize themselves with sections of the technical framework that describe interfaces between systems under their supervision. Developers and systems integrators should have a detailed knowledge of the sections of the technical framework relevant to their systems. IHE can make systems integration faster, more efficient, less expensive and more successful. Standards-based integration solutions like those defined in IHE are more flexible, more durable, easier to implement and less expensive to maintain than proprietary methods. Achieving systems integration through IHE is a dramatic step toward providing optimal patient care.

IHE has produced a milieu for open discussion among medical information system vendors, users, and other interested parties (e.g. standards bodies, professional societies) on how to better integrate heterogeneous computer information systems with the goal of improving patient care. IHE provides a detailed process of interoperability testing called the IHE "connectathon" and "demonstration" to facilitate adoption of

this framework by industries of the imaging and information systems.

Summary

To obtain a gold standard in dental IMIS implementation, it is necessary to participate in strategic, technical, and planning committees, both within radiology and in other areas under development. The IHE and its technical framework are good for the patient, the healthcare provider and all information systems vendors. IHE has created standards-based integration solutions which are more flexible, more durable, easier to implement and less expensive to maintain than proprietary methods.

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