Integrating the Healthcare Enterprise: A Primer

Part 1. Introduction[1]

Eliot L. Siegel, MD • David S. Channin, MD

Does the subject of this series of articles intrigue you but you're not sure if the topics covered really apply to you and your practice? Before you read another word, go to the end of this introduction and seriously try to answer the questions posed there. If you answer "yes" to questions 1, 4, 5, 6, and 7, you need to read these articles.

And they said, "Go to, let us build a city and a tower, whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth." And the Lord came down to see the city and the tower, which the children of men builded. And the Lord said, "Behold, the people is one, and they have all one language; and this they begin to do: and now nothing will be restrained from them, which they have imagined to do. Go to, let us go down, and there confound their language, that they may not understand one another's speech." So the Lord scattered them abroad from thence upon the face of the earth: and they left off to build the city. Therefore is the name of it called Babel; because the Lord did there confound the language of all the earth: and from thence did the Lord scatter them abroad upon the face of all the earth.—Genesis 11:4–9

Introduction

With the arrival of the new millennium, we find ourselves well into the "information age" with respect to healthcare delivery. Improving the delivery of healthcare both in a quantitative and qualitative sense will depend on improving management of digital information within and among healthcare institutions. Currently, within a given healthcare setting, there are typically dozens of information systems that each perform specific functions. There might be, for example, a billing system, an admission/discharge/transfer (ADT) system that registers patients, as well as numerous departmental systems (eg, radiology information system and picture archiving and communication system [PACS]). To optimize "information efficiency," these systems need to intercommunicate such that end-users of the system have the information they need to make their decisions and get their work done, when and where they need to do so. Historically, many of these information systems developed as monolithic, stand-alone systems without significant interfaces to other systems. Fortunately, the advent of medical information systems standards such as HL7 (Health Level 7) (1)

and DICOM (Digital Imaging and Communications in Medicine) (2) have created a mechanism to share patient data and optimize work flow.

These and other standards, however, are necessary but not sufficient for the successful integration of heterogeneous information systems. Consider, for example, the case of the light bulb. Very early in the evolution of the light bulb, there were numerous, vendor-specific types of bulb bases. This multiplicity of design caused great havoc among lamp manufacturers and consumers until a limited set of bulb base designs became industry standards. Now consider the situation if a lamp were used for signaling. The sender and receiver can both choose from a number of different vendors of signaling lamps. Both sender and receiver units can use any number of standard light bulbs, wiring systems, and sources of electricity. If, however, the sender and receiver do not agree on the framework for how they are going to blink the links, then the standards they have implemented (bulbs, wiring, electricity) will not succeed in fostering the desired communication.

Similarly, the typical healthcare enterprise continues to suffer with a situation analogous to the biblical "tower of Babel," whereby each hospital information system utilizes HL7, DICOM, and other standards in a wide variety of ways as to practically preclude communication of information from one to another. Consequently, these systems often operate almost completely independently, with a paper printout typically serving as the only means of communication. This lack of consensus by various hospital and radiology information systems, PACS, and modality vendors on how to use existing standards has thwarted our efforts to automate processes such as physician order entry, patient and examination registration (especially for the challenging "John Doe" patient), and the creation and review of imaging reports. The failure to automate these processes has resulted in a very inefficient work flow, despite the use of electronic information systems.

The Integrating the Healthcare Enterprise (IHE) initiative defines such a consensus effort and framework (3) for integrating information systems in a healthcare environment. A joint effort of the Radiological Society of North America (RSNA) and the Healthcare Information and Management Systems Society (HIMSS), the IHE initiative began in 1998 as an effort to more clearly define how existing standards, notably

DICOM and HL7, should be used to resolve common information system communication tasks in radiology. The IHE technical framework defines, precisely, a common information model and a common vocabulary for systems to use in communicating medical information. It then specifies, precisely, how DICOM and HL7 (so far) are to be used by information systems to complete a set of well-defined transactions that accomplish a particular task. At the same time, the framework provides a common human vocabulary that professionals and vendors can use to discuss further problems of this nature.

Modality and medical information system vendors have rapidly become strong supporters and architects of the IHE effort. Vendors came together to demonstrate the way in which actual products could support this next level of integration. The first demonstration was held at the RSNA annual meeting in 1999 and again at the 2000 annual meeting of HIMSS. The initiative was expanded in its second year and shown at RSNA 2000 and HIMSS 2001. The Year 3 efforts will be on display at this year's RSNA meeting and at next year's HIMSS convention.

The following two articles are the first two parts of a four-part primer designed to further explain the IHE initiative. The first article will detail the seven "integration profiles" that are currently defined in the IHE technical framework. This piece will define the common language of the framework that allows professionals and vendors to describe the problems and their solutions. More detailed descriptions of common problems in radiology and how the specific integration profiles address these specific scenarios are presented. Again, non-radiology healthcare information system users and providers will be able to identify analogous problems within their domains and subsequently be equipped to formulate their solution in terms that the IHE community can act on.

The second article attempts to explain what IHE does for each of the different users of medical information systems, currently aimed at radiology processes and procedures. Other healthcare information system users and vendors will, we believe, see in these descriptions analogous problems and scenarios that arise in their domains. They will also discover that the IHE initiative is an extensible vehicle that can and will be expanded to meet the challenge of these needs in other medical domains besides radiology. Users (through their professional organizations), vendors, and standards organizations are invited to

participate fully in the IHE initiative and are encouraged to contact the IHE project offices at the RSNA or HIMSS headquarters.

The third and fourth articles will be published in the November 2001 issue of *RadioGraphics*. The third piece will detail the role of existing standards in the IHE initiative. IHE is not a standard nor is the initiative a standards body. IHE is not a certifying authority. The IHE community of vendors and users makes use of existing standards, notably DICOM and HL7, to achieve the integration goals of IHE. This third article will detail some of the newer components of DICOM and how they relate to IHE. It will also examine how HL7 is evolving to meet the challenge of more complex information system integration demands.

The fourth and last article will explain the future of IHE. The Year 3 (2001/2002) demonstration will be described in more detail. This article will include practical aspects of how to include IHE requirements in contracts and requests for proposals. Future directions of the IHE initiative and mechanisms by which other users, vendors, and organizations can participate will be described. It is only through this further participation by users and vendors that the IHE initiative can grow and flourish. The plans for expansion of the initiative outside radiology will be presented.

In addition to this primer series, more information about the initiative, including the latest version of the IHE Technical Framework, can be found at the IHE web site: *www.rsna.org/IHE.*

Questions for Consideration

1. Do you have communication problems in your work flow and between your information systems that you think IHE could help you resolve?

2. Does the Scheduled Work Flow integration profile adequately represent or codify the way you perform radiologic procedures? If no, how is it lacking?

3. Are the distinctions between Order, Requested Procedure, Scheduled Procedure Step, and Performed Procedure Step clear to you? Does this hierarchy adequately capture the complexity of performing radiologic procedures?

4. Is the performance of grouped procedures a significant problem for you? Does the Presentation of Grouped Procedures integration profile address this scenario adequately? If no, how is it lacking?

5. Do you have significant clinical or operational problems related to making images appear similar on film and on workstations? If yes, do you use the DICOM (part 14) gray-scale display function standard to calibrate your equipment? Does the Consistent Presentation of Images integration profile adequately address this issue? If no, how is it lacking?

6. Do you have significant problems managing paperwork (requisitions, notes, patient history, etc) in addition to films and images? If yes, does the Key Image Note integration profile address these needs? If no, how is it lacking?

7. Do you have significant management problems in reconciling unknown patients, performing procedures on trauma patients, or performing procedures when one or more information systems are unavailable? If yes, does the Patient Information Reconciliation integration profile address these scenarios adequately? If no, how is it lacking?

8. What other aspects of radiology work flow could benefit from IHE type integration profiles?

9. Are there any related topics that you would like to see discussed or clarified in future articles or presentations?

References

1. Health Level Seven. Application protocol of electronic data exchange in healthcare environments, version 2.4. Ann Arbor, Mich: HL7, October 2000.
2. National Electrical Manufacturers' Association. Digital Imaging and Communications in Medicine (DICOM). Rosslyn, Va: NEMA, 1996; PS 3.1-1996–3.13-1996.
3. Radiological Society of North America/Healthcare Information and Management Systems Society. IHE technical framework, year 3, version 4.6. Oak Brook, Ill: RSNA March 2001.