Chapter IV

Teleradiology: IT-Based Co-operation and Networking in Public Health

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In most countries of the world, public health is an important indicator for the prosperity of a society. However, due to increasing deficits in public households, more and more conflicts arise between new medical approaches and traditional medicine, between technology-centered and human-centered care, and between increasing demands of patients (societies) and limited, sometimes even decreasing healthcare budgets.

In this context, telecommunication-based medicine (telemedicine for short) provides for economies of scale, for sharing of investments, for speeding up clinical and healthcare business processes, for bridging geographical distances and, last but not least, for fundamentally re-designing, and innovating diagnostic, administrative, therapeutic and nursing processes (Hammer, 1993; Berger, 1997).

Telemedicine-networks can only be established and operated efficiently
• if all relevant information and objects are in digital form (providing for a dematerialization of healthcare processes!)
• if high-speed networks are available with acceptable bandwidth,
• if the telemedicine-software can be integrated with the administrative and clinical systems of healthcare institutions, and
• if the clinical and administrative processes of healthcare institutions are adapted to the challenges of telemedicine.

Up to now, it is quite usual to support administrative processes (such as billing), patient management, education, research or procurement by telematics. In contrast, telematics in diagnostics and therapy is still at its very beginning in most countries. First examples are emerging in telepathology, in teledermatology, and in telerobotics for surgical operations. The most emergent field in telemedicine, however, is teleradiology. Probably the most important reason is that information, objects, and thus most processes in radiology can be dematerialized much more easily than in other clinical fields.

Regarding the points mentioned above, and with particular respect to the requirements of teleradiology, the current state can be characterized as follows:

- There is an increasing availability of digital modalities in hospitals. Thus, digital representations of images will be standard in the near future.
- The Internet provides a public infrastructure for telecommunication. Increasing bandwidth provide for a much better reliability than in the past. Recent achievements in communication security (e.g., electronic signatures, virtual private networks, tunneling) facilitate the development of telemedicine applications (Müller, 1999).
- Expenses for telecommunication (dollar per unit) are decreasing rapidly due to technical innovations, extensive worldwide competition, cost reduction in hardware, etc.

However, there are also open problems, in particular in software management / software technology, in the future development of standards (HL7, Dicom), and, finally, in the organizational systems/management structures typically found in public health organizations.

Information systems in healthcare are not at all open systems. For example, the architectures of most systems do not meet the state of the art in software technology. Modularization, object orientation, component technology, open interfaces and the like are still not common today. Even the commitment to standards such as HL7 or Dicom that are really important for teleradiology cannot be taken for granted. This is quite an important difference to up-to-date information systems in industry and manufacturing.

Problems in management include that the IT departments of most public health institutions are not very experienced in large software projects, and in running/maintaining inter-hospital computer networks. On the side of software companies, there are bottlenecks in manpower (Y2K problem, Euro, fairly not enough programmers/IT experts on the market) and in competence (in particular, system integration, operation/maintenance of large inter-organizational computer networks, telematics, IT support along the healthcare value chain).

A particular technological risk relates to the further development of the standards HL7 (representation/transmission of textual and numerical information) and Dicom 3.0 (representation/transmission of images). The definitions of both standards are not consolidated yet. Problems may arise due to the rapid success of the new Internet standard XML (eXtended Markup Language). XML provides quite a natural way to structure and access documents composed of text, images, audio and video sequences. The historical reasons behind the distinction into these two standards have therefore become obsolete already. Thus, an upcoming integration of HL7 and Dicom may be expected (HL7, 1999). Healthcare institutions then could apply to XML for ease exchange of information between disparate software applications. This, in turn, will impact the architectures and the functionality of future hospital information systems (HIS) as well as of dedicated radiology information systems (RIS).

On the organizational side, problems of change management are important. They result from the specific organizational cultures in healthcare, from shortcomings in process management, and also from inefficient management structures in public health institutions. This may cause risks and difficulties (i.e., cost-raisers) if technology-driven change management aims to adapt a healthcare institution to a new organizational situation.
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