PACS, SRR and the future of radiology

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The complex organization of the Canadian health care system has led to fragmented care, and challenges in interdisciplinary communication. Advances in technology, however, are rapidly enhancing the potential for multiple disciplines to communicate and integrate information. Many of these advances have been fostered under the leadership and influence of radiology.

Innovation is described as having two components: the development of new technologies, and their adoption into clinical practice. Both are required for a real impact in medicine. Beginning with Roentgen’s discovery of x-rays, innovation in new imaging techniques like ultrasound, CT and MRI has propelled radiology to the forefront of cutting edge medical science. Furthermore, leaders in radiology have pioneered efficient communication and electronic storage strategies to more efficiently adopt these imaging modalities into clinical practice, accessible to a larger group of caregivers. Picture Archiving and Communication System (PACS) is just one example that has now been implemented in hospitals across the country and throughout the world.

The field of radiology has been exemplary in using innovation to facilitate multidisciplinary care. Often, however, these innovations are adopted or completely taken over by other specialties resulting in “turf wars”, which create animosity, hindering collaboration on a fundamental level. In addition, it is possible that since technology has reduced face-to-face time in non-medical realms (e.g. Facebook, online chat, blogs), it could also negatively impact communication in medicine. This article argues, however, that an increase in computerized communication is a positive development for interdisciplinary collaboration owing to the nature of the technologies used. This article will also outline some examples of current technology that have come to symbolize the concept of computerized clinical integration.

Despite literature that bemoans the decreased clinical presence of radiologists caused by technology, its advantages to patient care cannot be ignored. A radiologist stated, “the saying tempora mutantur is as true today as it was in the days of the Romans: times change, and we must change with them.” Radiologists have been pivotal in developing these modern technologies and now must adapt to best reap their rewards.

**PICTURE ARCHIVING AND COMMUNICATION SYSTEM**

PACS refers to the electronic storage of multimodal data including imaging studies, reports and patient identification information. PACS replaces hard copy data (films and paper records) and allows the integration of imaging with other systems such as the Electronic Medical Record (EMR). There are several storage formats for PACS, which all generally include images (which can be CT, MRI, US, PET, endoscopy, mammography, ophthalmology, etc), a secure network, multiple workstations (which can exist at multiple hospital sites), and patient archives. PACS facilitates remote access, and is used by radiologists to perform teleradiology, or off-site image interpretation. Integrated into PACS is a workflow management system, which allows for an efficient asynchronous communication system. In other words, once the image is acquired, preliminary comments can be made by the technician or referring physician. In addition, if a diagnosis is made immediately and acted upon, say in the ED, this is recorded and can be later re-evaluated by the radiologist who can either agree or disagree with the original impression. This allows for a system where discrepancies can be recorded and later studied for particular patterns of error.

In the study by Mates et al., an additional communication tool was implemented alongside PACS, called Collaborative Notification System (CNS), which was used in the setting of urgent or emergent radiology. CNS consists of a pager notification system between the radiologist and referring physician, and allows for images to be read immediately, and the diagnosis paged to the referring physician who can then acknowledge its receipt. The system was shown to improve documentation, and provided an exact record of the communication, which would not be available with person-to-person communication. CNS is just one way in which PACS has been shown to facilitate radiologist workflow.

Additional benefits of PACS include an increase in image availability as well as a decrease in time spent travelling to the radiology department. Another report demonstrated that PACS enhanced communication between radiologists and referring physicians by decreasing errors related to incorrect patient identification, and increased the efficiency of meetings by providing readily available images and reports. More manageable workflow and increased efficiency of inter-physician communication are undeniable here. Unfortunately for radiologists, however, more accessible image data may lead to an increase in the number of non-radiologist physicians who interpret radiological studies.

**SPEECH RECOGNITION REPORTING**

Speech Recognition Reporting (SRR) has been widely available in health care worldwide for the last 15 or so years, but recently improvements have been made such that the voice recognition systems are more sophisticated, requiring less voice-training time with increased word-recognition accuracy. Radiologists have been a major consumer of SRR as it has been shown to significantly reduce the time between examination and report finalization. Traditionally, radiologists would dictate reports, which were recorded and transcribed at a later time, and finally verified by the radiologist and signed off for inclusion in the patients chart or EMR. With SRR, voice is converted directly to text after the SRR software has been signed off for inclusion in the patients chart or EMR. The use
of SRR alongside PACS has been shown to significantly reduce report completion time as well as significantly increase the number of reports which are available within 24 hours⁶.

Another benefit of SRR, shown by Bhan et al., is the decrease in overall hospital operating costs⁷. The same report, however, published data showing that SRR actually increased the amount of time taken to produce individual reports, and was prone to inaccuracies in certain settings, for example, when used by practitioners for whom English was a second language. Speech Recognition Reporting was shown to have no effect on the overall number of reports produced. Despite some of its shortcomings, SRR has recently shown vast improvement and will undoubtedly continue to do so. It has become a mainstay for many radiologists and other specialties alike and has the unique ability to be combined with systems such as PACS to provide a more complete composite of patient data, benefitting all members of the interdisciplinary team.

THE FUTURE OF RADIOLOGY

Since many technologies have improved the efficiency and accuracy of radiological reporting, there has been a parallel increase in the adoption of radiological techniques by other specialties. This is known as many as radiology "turf wars". The most prominent examples over the past 40 years are in vascular surgery and coronary angiography. One author speculated that the reason for the total cessation of radiologists performing these procedures was their lack of specific knowledge in the clinical aspects of coronary artery disease (especially electrocardiology and cardio pharmacology) as well as the ability of cardiologists to self-refer⁹. Palma notes that since radiologists are not trained in the catheter lab and do not conduct research in coronary disease, they are less adept to perform coronary angiography. Thus, radiologists have largely abandoned this practice. One study showed that the total number of intravascular procedures performed by radiologists fell from 63.6% to 49%, while those performed by cardiologists rose from 25% to 36% from 1997 to 2002¹⁰. Radiologists, however, have longer and more highly specialized education that includes in-depth radiation safety training, familiarity with all imaging modalities, and ability to detect incidental findings¹¹, which suggests that they are better suited for these procedures. The previously mentioned phenomenon of self-referral has also been explored and shown to lead to an increasing and unnecessary utilization of radiological services by non-radiologists¹².

The high level of technical ability inherent in radiology has led to a real or perceived weakening of the clinical relationship between radiologist and patient. Therefore, there has been a recent push towards solutions termed "clinicalisation", which reinforce the clinical role of radiologists and their technologies¹³-¹⁵. Clinicalisation also seeks to help radiologists better communicate with other disciplines by recommending training for radiology residents in specific organ pathologies, and supports the physician-patient relationship by encouraging radiologists to maintain contact with the patient in all phases of treatment¹³. Additionally, centers in the United States have explored the possibility of using online images to increase patient access. This was found to increase patient satisfaction, and support the relationship with and identification of the radiologist as a professional responsible for diagnosis and treatment¹⁴.

CONCLUSION: WILL TECHNOLOGY HELP OR HINDER RADIOLOGISTS?

Innovation in radiology is influencing many aspects of medicine that include communication, management, diagnostics and therapy. The future of radiology undoubtedly involves further development of PACS and SRR systems and their becoming so widespread that transmission of images and reports to patient smart cards, nationally or internationally is possible.¹⁵ Telemedicine and videoconferencing will also enhance large-scale communication. The next few decades will see further advances in nanotechnology, molecular imaging, and new forms of percutaneous treatment. Radiologists who have expertise in electronics and informatics, a foundation of specialized clinical pathology and excellent bedside manner will help shape the way innovation is implemented in day-to-day medicine.

REFERENCES