Image Distribution in a Multi-facility Radiology Practice

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The Cleveland Clinic Health System is a multifacility practice that distributes images electronically. Issues specific to the internal department at the main campus must be addressed with regard to the overall commitment to the healthcare system. Training for new and old employees on diagnostic and transcription equipment is a key issue. Interfacing different systems or different configurations of a system, either hospital or radiology information systems, is many times difficult and sometimes insurmountable. Issues of confidentiality have been addressed. In light of the impending new regulations from the Health Insurance Portability and Accountability Act, are the current system security practices enough?

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THE CLEVELAND Clinic Health System is comprised of multiple hospitals ($n = 7$), several family health centers ($n = 6$), and off-site orthopedic practices ($n = 2$). The main campus houses the central image archive with off-site workstations and servers connected with the main campus and each other. All digital images from magnetic resonance (MR), ultrasound, nuclear medicine, digital radiography, computer radiography, computed tomography (CT), and digitized radiographs are transferred among sites that have diagnostic level workstations. Workstations on clinical floors are in the neurosurgery, orthopedic, cardiology, and oncology departments. Clinical workstations are also available at the family health centers and several physicians' homes. Workstations are capable of receiving, sending, archiving, and retrieving images from the server. Images from off-main campus sites are pushed to the workstation for the appropriate radiology specialist to interpret. The on call radiology specialist has a PC-based (four platforms available) Digital Imaging and Communications in Medicine (DICOM) viewer on their home desktop or laptop computers. Connections to the server are by ISDN lines, DSL lines, and phone lines for laptops. Standardization of minimum configuration requirements for home computers necessitated purchasing new computers by several of the radiologists. Retrieving images is relatively slow for the on call radiologist, especially CTs. The average head CT requires about 5 minutes when compressed using a quality factor of .80. Most images are pushed to on-call radiologists. Maximum efficiency in utilizing the viewer

is not achieved rapidly by new radiologists since learning the system is either by trial and error or an "apprenticeship" program learning from other radiologists.

The radiology department employs 70 radiologists. In addition to the main campus, three other hospital radiology departments are serviced by Cleveland Clinic Foundation radiologists. The main campus transfers images on an imaging network as part of the institutional local area network (LAN). Outlying hospital departments are connected to the imaging network via T1 lines and frame relay. All digital images are stored at the main campus on a long-term archive. Recent images are stored on sub-servers for more rapid retrieval.

Specialty radiologists read digital studies from all departments at the main campus for neuroradiology and musculoskeletal studies except for one site where a musculoskeletal specialist is stationed. All sites use the main campus as a consultation service. One site utilizes a web-based radiology information system (IDX, Burlington, VT) exclusively and the main campus uses the web-based software in the neuroradiology and musculoskeletal sections. The web-based software allows the radiologists to examine the studies ordered at all on-campus and off-campus sites (including all of site MRs and CTs). Protocols can be entered into web-based software prior to the study for the technologists. Prior reports and studies can be retrieved. Emergency cases are flagged and the interpreting radiologists can immediately identify and report the study. Studies interpreted are flagged so that a radiologist at any site knows the study is completed. Studies can be retrieved at any site so that the most available specialist can interpret the study. Clinical data is also provided with the ordering physicians phone number so that clar-

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ification of orders and history may be easily obtained. Once interpreted and finalized the report is transferred to the electronic clinical record automatically by a Health Level 7 (HL7) interface. Speech recognition (Talk Technology, Bensalem, NJ) is used by neuroradiology and to a lesser extent by musculoskeletal radiology providing instant reporting.

Medical and surgical staff, until recently, has been reluctant to utilize viewing stations in the clinic and surgery. The reasons are multifactorial. Some older physicians are not computer savvy and are reluctant to change habits. Pulling studies take time and logistically the radiology department cannot push images throughout the main campus that has over a million outpatient visits a year. Multiple

workstations are required costing millions of dollars in computer equipment and software licenses. Can the network handle the volume? Old studies and outside studies may not be digital that requires continued use of view boxes. Many physicians review studies with patients. The patient must then either leave the examining room or a viewer must be in each examination room. Surgical cases will require operating room safe monitors. The question must be raised asking whether the referring physician will require the entire study or representative images and will that satisfy them? Finally, can a web browser technology provide adequate security outside the institutional firewall in light of the Health Insurance Portability and Accountability Act electronic medical record legislation?