Radiologist-Patient Interactions: Implications for Picture Archiving and Communications Systems and Teleradiology

Eric E. Williamson and Byrn Williamson Jr

We analyzed radiologist-patient interactions and found that radiologic examinations can be classified into three categories: those involving direct interaction of the radiologist with each patient, those involving interaction of the radiologist with some of the patients, and those that do not involve interaction between the radiologist and the patient. We then analyzed the staff assignments of a large academic radiology practice and a moderate-sized radiology department. Both departments include a full range of inpatient and outpatient procedures. We concluded that about 50% of the radiologists in these practices could interpret examinations at a location independent of the site where the examination was performed. This type of analysis can be helpful in planning for the reengineering of radiology processes following implementation of picture archiving and communications systems (PACS) and teleradiology.

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PICTURE ARCHIVING and communication systems (PACS) and teleradiology offer the potential for interpretation of imaging examinations to be geographically separated from the site of image acquisition¹⁻³; however, some radiologic examinations require the presence of a radiologist, either because of direct interaction with the patient or because of the risk of reaction to intravenous (IV) contrast material. We analyzed the radiologist-patient interactions for various types of radiologic examinations and studied the staffing requirements for a large academic center and a moderate-sized practice.

MATERIALS AND METHODS

We defined the following categories of radiologist-patient interaction:

Direct radiologist-patient interaction—The radiologist must be present for every examination. Examples include angiography, interventional procedures, and fluoroscopic studies of the gastrointestinal tract.

Variable interaction—The radiologist directly interacts with some of the patients or must be available in case of adverse reaction to intravenous contrast media. Examples include examinations involving IV contrast injections, as well as ultrasound examinations that may involve scanning by the radiologist when scans by the sonographer are indeterminate.

No interaction—The radiologist does not need to be present for the examination. Common examples are plain films of the chest and bones.

We then analyzed the schedule of clinical radiology duties at Mayo Clinic Rochester, including outpatient and inpatient practices. Mayo Clinic Rochester is a large academic radiology

practice with an average of 50 radiologists assigned to clinical duties each day. Approximately 750,000 radiologic examinations are performed at Mayo Clinic Rochester per year.

We also analyzed the radiology staff schedule at Mayo Clinic Jacksonville, including the outpatient facility and St Luke's Hospital. This is a moderate-sized radiology practice with an average of 17 radiologists assigned to clinical duties each day. Approximately 180,000 radiologic examinations are performed at Mayo Clinic Jacksonville per year.

In analyzing the staff schedules, assignment of activities to the categories "direct radiologist-patient interaction" and "no interaction" was relatively straightforward. The determination of the number of radiologists needed to be on site in the "variable interaction" category was more difficult. The following assumptions were used in making these estimates:

- Nurses administer intravenous contrast material, but a radiologist must be available to provide prompt treatment of reactions to all IV contrast media including gadolinium.
- One radiologist can provide coverage for several patients receiving IV contrast material.
- The decision to administer intravenous contrast media for body magnetic resonance (MR) and computed tomography (CT) examinations is generally made after the patient arrives for the examination, so it is not possible to assign patients prospectively to a "noncontrast" scanner.
- About one third of ultrasound studies require a radiologist's participation in the examination.
- We perform two types of mammographic examinations. Screening mammography, which is performed in asymptomatic patients, comprises approximately one-third of our practice and does not involve radiologist-patient interaction. Diagnostic mammography, on the other hand, involves a radiologist's interaction with virtually every patient.
- In our practice, body CT and MR examinations, excretory urograms, and ultrasound examinations are monitored and tailored by radiologists who view the images during the examination. For the purposes of this analysis, we have assumed that technology would be adequate to allow radiologists to direct these examinations from a remote location; however, we have not proven this assumption in practice.

RESULTS

At Mayo Clinic Rochester, approximately 22% of clinical radiologists perform examinations requiring direct patient interaction on a given day, and

From the Mayo Clinic Jacksonville, FL; and the Mayo Clinic Rochester, MN.

Address reprint requests to Byrn Williamson Jr, MD, Mayo Clinic, 200 First Street, SW, Rochester, MN 55905.

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approximately 26% interpret examinations that require no interaction with the patient. The other radiologists fall into the "variable interaction" group. Further analysis of this group suggests that an additional 22% of radiologists must be available for patient interaction during their examinations while the remaining radiologists could be located at another site. Thus, approximately 56% of staff radiologists at Mayo Clinic Rochester could be located at a site other than the site of examination.

Similarly, at Mayo Clinic Jacksonville, approximately 18% of radiologists are involved in direct patient interaction and 24% interpret examinations that do not require patient interaction. Of the remaining radiologists, an additional 29% need to be on-site for potential interaction with patients. Thus, approximately 47% of radiologists need to be located on-site, and the remaining 53% can perform their duties independent of the site of the examination.

DISCUSSION

Our analysis suggests that approximately half of the radiologists at both the large academic department and the moderate-sized practice are not required to have direct patient contact and do not need to be located at the site of examination. This

capability may lead to increased efficiency through work-sharing among radiologists on a single campus or located at separate geographic sites. It is important to note that implementation of a virtual radiology department will not necessarily involve interpretation of imaging examinations at remote locations. The opportunity to redistribute the workload within a single campus will probably be of equal or greater importance.

These results are obviously theoretical, and actual implementation will probably require changes in our assumptions. For example, this analysis does not address the need for face-to-face consultation between the radiologist and the referring physician, particularly in complicated cases or in a busy emergency department.⁴ In addition, this model ignores other important functions such as teaching conferences and supervision of personnel. Any plan for reengineering radiology processes must take into account more activities than just the interpretation of images. Nevertheless, this type of analysis can serve as a basis for planning for a virtual radiology department. As PACS and teleradiology are adopted more widely, more radiology practices will have the opportunity to reengineer their processes and redistribute their radiology staffing.

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