

Coordinating Patient Care Within Radiology and Across the Enterprise

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For the practice of radiology, the transition to filmless imaging operations has resulted in a fundamental transition to more efficient clinical operations. In addition, the electronic delivery of diagnostic studies to the bedside has had a great impact on the care process throughout the health care enterprise. The radiology information system (RIS) has been at the core of the transition to filmless patient care. In a similar manner, the electronic medical record (EMR) is fundamentally and rapidly transforming the clinical enterprise into paperless/digital coordination of care. The widespread availability of EMR systems can be predicted to continue to increase the level of coordination of clinical care within the EMR framework. For the radiologist, readily available clinical information at the point of interpretation will continue to drive the evolution of the interpretation process, leading to improved patient outcomes.

Regardless of practice size, efficient workflow processes are required to best leverage the functionality of IT systems. The radiologist should be aware of the scope of the RIS capabilities that allow for maximizing clinical benefit, and of the EMR system capabilities for improving = clinical imaging practice and care coordination across the enterprise. Radiology departments should be actively involved in forming practice patterns that allow efficient EMR-based clinical practice. This summary article is intended to assist radiologists in becoming active participants in the evolving role of both the RIS and EMR systems in coordinating efficient and effective delivery across the clinical enterprise.

Key Words: Workflow, electronic medical record, radiology information system

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OVERVIEW

The radiology information system (RIS) is considered the core system for the electronic management of imaging departments. The electronic medical record (EMR) is the core informational system for patient management across the health care system. Within a radiology department, major functions of the RIS can include patient scheduling, resource management, examination performance tracking, examination interpretation, results distribution, and procedure billing. The widespread adoption of PACS requires additional practice management workflow coordination, including the creation and distribution of images within the imaging department and throughout the imaging enterprise. The introduction of the PACS established an interdependent relationship between the RIS and the PACS. Optimal efficiency for the imaging department occurs when PACS and RIS integration enables seamless information sharing between the RIS and the PACS.

Traditionally, workflow within many radiology departments was considered a closed system; the workflow

began when the paper-based imaging order was received in radiology, and ended when the paper-based result was delivered to the clinician. Introduction of the PACS fundamentally changed the relationship of radiology to the enterprise, as immediate availability of images to the enterprise was considered a capability as important as distribution of the radiologist's interpretation. Today, many radiology departments have begun to transition from simply making images and reports available to the enterprise to using an integrated, enterprise-wide clinical workflow. Paper-based imaging requests are being supplanted by electronic orders originating in both the RIS and EMR systems. In many practices, decision-support tools assist the clinician in requesting the appropriate procedure for the patient's clinical presentation. The ever-increasing influence of the EMR workflow on order entry and clinical management further affects the workflow within radiology departments; radiology workflow now often originates within hospital- and office-based EMR systems and ends when the images and report are available in the same EMR systems.

By understanding the capabilities of a RIS/PACS and EMR systems, radiologists can facilitate the implementation and optimization of these systems within their clinical practice. In this article, the reader is presented with the transitional roles of the RIS and PACS, the interdependency of these systems leading to

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integrated RIS/PACS, and the potential impact of EMR systems on radiology practices.

RADIOLOGY DEPARTMENT COMMON INFORMATION SYSTEMS AND PROCESSES

In a radiology department, numerous processes are used to manage procedure preparation for interpretation by the radiologist. Standard business practices manage results distribution, procedure coding and billing processes.

Procedure Performance Workflow

The steps involved in initiating and performing a procedure are as follows:

1. Order entry: the process of capturing the clinician's request for performing a procedure. This entry includes the patient's clinical history and indications for the requested examination. The order-entry process can be managed directly by the radiology department. This process is migrating to computer-based systems that directly capture the clinician's instructions. Computerized decision-support processes can be integrated into the selection and approval of appropriate procedures for a given clinical presentation. With the widespread adoption of EMR systems, clinician order-entry processes are likely to be initiated within the EMR, and orders will then be transmitted to the RIS (see EMR Systems section);
2. Preauthorization: the process by which an insurance provider provisionally approves reimbursement for an examination. In some practices, using a third-party "appropriateness" tool or process provides the required authorization. The specific requirements for approval vary by state, insurer, proposed examination, and the patient's level of clinical acuity;
3. Gathering patient demographic and insurance information: This information is necessary to provide continuity of care, to access a patient's prior imaging studies, and to allow proper billing at the conclusion of the procedure;
4. Creating an accession/procedure/exam order number: a process to manage the performance of an examination. An accession number is typically issued by the time the patient arrives in the radiology department but could be issued when the imaging order is received. The accession number coordinates with the PACS/RIS to ensure that reports are linked to proper examinations in the PACS;
5. Scheduling the ordered procedures: This step involves the scheduling of the ordered procedure, as well as maintenance of a list of both scheduled procedures and available appointment openings;
6. Performing the procedure: the technologist performs the scheduled procedure and tracks (time stamps) the process steps of examination performance;

7. Managing the modality worklist: This step is a process of automatically transferring the patient's procedure information directly to the imaging modality. Utilization of the modality worklist eliminates manual entry of patient information into the imaging console; thus, the worklist reduces manual data entry errors and facilitates greater fidelity of RIS/PACS data flow;
8. Managing the interpretation workflow: a process by which completed cases are provided to the radiologist for interpretation. Management systems create and maintain radiologist task lists (or worklists) of unread procedures with images and reports available for interpretation;
9. Distributing results: the process that informs the ordering clinician of the availability and result of the procedure interpretation. In addition, this process makes results available directly to the patient (required for Meaningful Use). Results include both images and a report. Providing notification and communication of unexpected results is an important component of the results distribution process;
10. Managing coding workflow: the process by which completed results receive Current Procedural Terminology (CPT) and International Classification of Diseases (ICD)-9 coding regarding the examination performed, the patient history, and the indications required by insurance providers to receive reimbursement for the examination;
11. Managing reimbursement workflow: the process by which the completed and coded procedure is transmitted to the responsible insurance provider or patient for payment.

Workflow Management

The core functions of an RIS are to facilitate and document procedure performance, manage results, and generate a billing record. Prior to purchasing any IT system, decision makers should understand the existing core workflows of their clinical practice. These workflows are components of "imaging order lifecycle management." The imaging practice needs to understand the components of its current process of fulfilling the imaging order request: examination protocol, image acquisition, delivery of report and study images to the clinician, and billing procedures. Workflow processes are improved when they are managed by systems that eliminate paper and automate the transfer of information between information systems. With the ever-increasing availability of EMR systems, workflow analysis will necessarily include consideration of computerized provider order-entry (CPOE) and decision-support systems, likely hosted within the EMR. Digital workflows enable greater transparency of given processes and enable process changes that can further improve imaging operations.

Order Scheduling and Resource Scheduling Management

Patient scheduling for most outpatient imaging procedures involves identification of an available imaging

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