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Too Much Information! What We Need From IT Beyond Image Manipulation Tools

Issues of image information overload have been described in this column (ie, the substantial rise in the number of images generated per examination, sometimes in the thousands, particularly with newer generation computed tomographic and magnetic resonance imaging scanners) [1,2]. This trend is likely to continue with next-generation image and data acquisition technologies and their expanding clinical application, such as in cardiovascular or oncologic imaging. Information technology (IT) vendors in the imaging domain are aware of this issue (whether they are addressing it optimally is another matter), and there have been many image manipulation innovations as small and large companies have tried to address advanced image visualization tools, such as in computed tomographic colonography. The optimal use of such tools will require appropriate integration into our daily work flow (eg, picture archiving and communication systems [PACS] and report generation tools) [1]. Much work lies ahead in this regard.

In this column, I describe another source of information overload for radiologists, nonimage information, and suggest approaches using IT to optimize its impact in our daily work. I use the term *nonimage information* to refer to patients' clinical information, such as physician office notes, discharge summaries, operative reports, pathology reports, allergies, medications, laboratory results, prior radiology reports, and so on. As the health care enterprise is being automated with adoption of electronic medical record (EMR) solutions, large portions of patients' medical records are being digitized and thus potentially made accessible to all who care for the patients. Imaging IT vendors have designed tools such as PACS to address radiologists' needs in general and have elicited feedback from our specialty to optimize such products for our use. Vendors of EMR technology have appropriately focused their products on the needs of our colleagues in other specialties. (Although one could accurately describe a PACS as an important element of an organization's overall EMR, for the purposes of this column, I arbitrarily distinguish PACS from EMRs.) The adoption of EMRs has created the expectation for access to relevant patient information as needed throughout the health care enterprise. Whereas it was impractical for radiologists to search patients' paper charts, our physician colleagues increasingly expect us to be familiar with patients' relevant clinical information beyond what is communicated to us through radiology requisitions, because we can access their EMRs. However, access to EMRs in radiology is not optimized. Most often, this access is either through a dedicated EMR workstation; less frequently, the EMR application is launched from a PACS workstation. In addition to logging into a PACS, a radiologist will typically need to log into the EMR and type in a patient's medical record number. The radiologist will then have to search the EMR to see whether a relevant piece of clinical information exists. For example, if one is interpreting an abdominal computed tomographic study, a report of prior abdominal surgery would be much more useful than one of prior knee surgery. Indeed, there may be no prior surgical reports. The only way to find out is to manually search for such reports in the EMR. One will have to go through similar activities in other relevant portions of the EMR. In my experience, it is not unusual to spend more time navigating an EMR than the patient's imaging study itself. The yield for the time spent searching an EMR for relevant and useful clinical information is highly variable and can be frustratingly low. Many times, the yield is too much information and not enough knowledge.

There are many IT-based strategies that can improve the usability of EMRs in radiology. I describe several briefly below.

SINGLE SIGN-ON

Single sign-on [3,4] allows a user to log into a workstation once for authentication and not have to log into each application separately, even if each application has a separate username-password combination. There are technology standards for accomplishing this goal, and as long as individual applications comply with these standards, one can accomplish the goal without the need to tediously and inefficiently log into various applications. Some vendors provide single sign-on solutions that can be used even if individual applications do not conform to single sign-on standards.

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SIMPLE CONTEXT SHARING AMONG APPLICATIONS

Technology solutions and standards already exist for sharing user and patient identifiers among different applications (http://www.ihe.net). As an example, the use of context-sharing IT solutions [4] will allow a user to avoid reentering medical record numbers in EMRs, if patients are already selected for viewing in PACS.

COMPLEX CONTEXT SHARING AMONG APPLICATIONS

Complex context sharing is needed, however, to enable radiologists to efficiently leverage the information in EMRs for the interpretation of imaging studies using PACS. In the example of abdominal computed tomography (the PACS is aware of the type of imaging study being viewed), the PACS can generate a request to the EMR for abdominal surgery, pathology reports, liver function tests, pancreatic enzymes, any prior office notes by the physician who requested the imaging study (the PACS is aware of the identity of the requesting physician), and so on. The relevant clinical information discovered in this way can then be displayed within the PACS, just as relevant prior imaging studies are displayed in many PACS today. There are many technology innovation examples that could help enable these desired functions.

SYSTEM-ORIENTED ARCHITECTURE AND WEB SERVICES

System-oriented architecture and Web services [5] will be a topic of a future column in more detail. Simply put, this IT architecture enables real-time standards-based access to data elements in EMRs from external applications (such as PACS). This is accomplished with necessary security and Health Insurance Portability and Accountability Act compliance. For example, a PACS can request all surgical or pathology reports for a given patient. Electronic medical record solutions in the future are likely to use this architecture more frequently and enable timely access to critical clinical information in the enterprise.

NATURAL-LANGUAGE PROCESSING

Natural-language processing solutions can analyze textual information queried from EMRs to create the desired information elements in PACS. In the abdominal computed tomography example cited above, natural-language processing could analyze the surgical report queried from the EMR and determine whether it is indeed an abdominal surgical report, and if so, display it in the PACS.

The increasing adoption of EMRs in health care can diminish the productivity of radiologists by creating inefficient access to a large amount of patient information. Optimizing access to relevant clinical information in EMRs using various existing and emerging IT standards and solutions will make EMRs more usable for radiologists and should improve the quality of their radiologic interpretations and the value they bring to patients. Thus, radiologists should participate in EMR purchase, implementation, and enhancement decision making whenever possible.

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