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Actionable Reporting

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Ultimately, any business is only as strong as the weakest link in its operational chain. This series has used the concept of the imaging value chain to identify sources of potential weakness and error within the imaging enterprise and then offered practical solutions for remedying those weaknesses to optimize patient care. In this column, we address the end product of all radiologic services, the imaging report.

All radiology operations should be geared toward the delivery of a timely, actionable report. Radiologists are first and foremost in the information business [1] and must therefore devise their operations and workflow toward the ultimate goal of producing text data that confer as precisely as possible the unique information inherent within the image data set in conjunction with other relevant biomarker and clinical data available in hospital databases. The report should be optimized to address the unique clinical question being asked by referrers. The value of any report relates to how helpful its information is in adjusting a patient's care and, hence, that patient's outcome. In other words, image data become pivotal information through a timely, actionable report.

As previously discussed in this series, an actionable report is the result of meeting the goals of the ACR's Imaging 3.0 initiative (imaging appropriateness, quality, safety, efficiency, and patient experience). Otherwise, the report may become inactionable well before the radiologist starts to interpret the images, such as when an inappropriate imaging study is performed or the wrong protocol is administered. Nor is a report fully actionable when modality operations are inefficient, with delays to patient access and consequently diagnosis, aside from undermining the patient experience. In short, a report can be truly actionable only if the totality of the imaging operation is geared to the delivery of appropriate, high-quality images ready for interpretation in a timely and safe manner while delivering an optimal patient experience.

Once at the workstation, radiologists need seamless access to all relevant prior studies. Sophisticated PACS work lists are critical in this regard, in that they triage patient images according to level of acuity (eg, stat reads are color coded or displayed at the top of the work list) and subspecialty mix. Ideally, all prior images are seamlessly available at the point of care, should a radiologist need to compare or incorporate information from remote studies to generate an actionable report (ie, in oncologic imaging). Any delay, however short, may increase the risk that a radiologist will fail to review the necessary prior data set such that an optimized, actionable report is not possible. All this requires sufficient bandwidth for rapid image delivery from remote servers, a challenge for some teleradiology applications.

Most radiologists recognize that an accurate history of a patient's presenting symptoms is required to synthesize any image findings into an actionable report. Yet the information provided is commonly inadequate. Naturally, it is important to remind referring physicians to outline patients' clinical problems as succinctly as necessary, but the process is challenging for most. Although some radiologists will diligently seek additional clinical history when it is inadequate, this process is inherently inefficient and often less than satisfactory (eg, the referring physician is not readily available). Ultimately, computerized image order entry software programs, particularly those with embedded decision support (see the second article in this series) [2], will mitigate many of these challenges because referring physicians, as part of the ordering process, are required to input relevant clinical data before an imaging test can be approved. Further free-text fields facilitate the display of additional relevant information, and a robust electronic medical record (EMR) will often remedy many clinical information deficiencies.

Most radiologists would agree that point-of-care access to the radiology information system is critical for actionable reporting because it allows immediate access to prior reports. However, many radiologists have not heretofore considered the importance of access to collateral biomarker (eg, pathology, blood work, genomic data) or clinical (fever, pain, drug, and medical or surgical history) data for the delivery of an actionable report. These and other relevant data are increasingly available in EMRs, which radiologists can now mine, at the point of care, to determine if data exist that can further shed light on pertinent imaging findings. For instance, it is possible that the cause of small bowel thickening is due to lisinopril administration, information typically available in the EMR. Rather than rendering a nonspecific report that identifies small bowel wall thickening of indeterminate nature, the radiologist can now inform the referring physician that the abnormality is likely due to a specific side effect of medication. Similarly, masses in the abdomen may be considered benign if key biomarker data are low or negative (ie, cancer antigen 125 in ovarian cancer). It is true that most EMRs still do not permit seamless data mining for this information, either because the EMR is not integrated to the patient in question in the PACS or mining the information is cumbersome and inefficient. However, newer EMRs are becoming

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integrated with PACS, and tools are now available that permit rapid EMR data searches for particular clinical scenarios (eg, is the patient on lisinopril?). Radiologists will now need to take an increasing responsibility for incorporating this information when reporting, thereby making their reports more meaningful, specific, and thus actionable. Fortunately tools are becoming available that present dashboards (on a third workstation) of premined key collateral clinical data at the point of care once a patient is selected from the PACS work list. For instance, in a patient with colon cancer, prior surgical, pathologic, chemotherapeutic, genomic, proteomic, and metabolomic data customized to the patient in question can be presented at the time of image interpretation. As such technologies mature, teleradiology practices may become increasingly susceptible to less than optimal actionable reporting, given their frequent lack of seamless connectivity with hospital EMRs.

The next challenge is to collate all the pertinent data from the image and clinical data set into textual information (ie, the report) that relays the information in as succinct and precise a format as possible. Voice recognition systems permit faster reporting and are strongly advocated (requiring a fourth workstation) because they are typically linked through the radiology information system to the PACS images and, importantly, offer structured reporting, a key tool for delivering actionable reports. Some radiologists believe their true value lies in crafting free-text reporting according to personal preferences. This idiosyncratic approach undermines actionable reporting because referring physicians are left having to navigate reports to find key actionable information, which inevitably varies from one radiologist to another. Structured reporting standardizes the report format such that the referrer can now easily navigate the information as key findings or recommendations positioned in the expected locations [3]. Further iterations of structured reporting can be refined around diseases (eg, pancreatic cancer) such that critical information required by surgeons, for instance, will always be included in a consistent and predictable format. Still in need of further development is the addition of quantitative data in nontext, useful visualization form (eg, tables, graphs, figures). Compared with words, these can be an effective and efficient means of communication. Similarly, hyperlinks embedded into a structured report can point referring physicians to the pertinent images discussed in the report.

It is well recognized that radiologists frequently recommend additional tests (with recommendations for follow-up imaging approximately 30% in some practices). Variation abounds, however, despite evidence-based guidelines, with one radiologist sometimes recommending a particular test at a certain time (eg, CT at 3 months) and another radiologist recommending a different follow-up test at another time (eg, MRI at 6 months) or sometimes no test at all. Such variation frustrates referrers, and many will often choose to ignore the recommendations altogether, thus undermining the entire goal of actionable reporting. Ultimately, consistent adherence to guidelines will only occur with the use of point-of-care decision support tools (ideally embedded into voice recognition reporting systems), which guide a radiologist in real time through evidence-based guidelines to automatically display the recommendations when appropriate in standardized language within a structured report [4]. Such tools increase adherence to guidelines from less than 50% to greater than 95%. Additionally, decision support tools offer the opportunity to deliver standardized lexicon so that terms such as *suspicious* and *likely* can be codified into a likelihood of risk. It is anticipated in the near future decision support reporting systems using big-data analytic tools will be able to assign risk weights to many detected imaging findings.

In summary, the goal of any imaging enterprise is to deliver timely, actionable information. The path to actionable information starts at the beginning of the imaging value chain by choosing the right test for the right patient at the right time and ends when a succinct structured report using standardized language, adhering to evidenced-based best-practice guidelines, is delivered to the requesting caregiver. Radiologists would do well to reengineer their work processes with liberal integration of IT support tools to achieve this goal.

The next article in this series will address report communication.

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