Imaging Informatics: Lead, Follow, or Become Irrelevant

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Despite the impressive technical acumen of the medical imaging industry, when one looks at the demands soon to be set upon us, radiology informatics is in its infancy. Over the past 20 years, imaging informatics systems, focusing on optimizing departmental efficiency and productivity, have been deployed at amazing rates [1]. However, as we advance toward a new era of government-influenced, interconnected, patient-centric health care, our maturing monolithic systems must be challenged if radiologists are to maintain their clinical significance. In this article, we describe the technologies that have, and will, become essential to maintain and improve our clinically relevant role in today’s evolving care process.

DRIVING FORCES: GOVERNMENT INFLUENCE, CONSUMERISM, ECONOMICS, AND QUALITY

In recent years, with increasing examination volumes and associated fee-for-service profits, the need for improved departmental productivity and efficiency has dramatically influenced our technology [2]. But now, with stronger government influence, the advent of health care consumerism, broader reaching economic controls, and sweeping national quality initiatives, our priorities and IT technology needs are rapidly being redefined.

Stronger Government Influence

Meaningful use, and the push toward electronic health records, is influencing hospitals, primary care, and radiology to demonstrate and record patient interactions. Subsequent phases of government influence will come in the way of accountable care organizations, whereby providers of care will be at greater risk for payments, being paid on outcomes, not procedures. And because imaging has matured into the fastest growing component of all physician-directed services over the past decade, there will be tremendous need to control it [3]. As opposed to profit centers, imaging services will become cost centers, requiring new forms of technology for management and oversight.

Consumerism

A new era of mobility is abounding: The physical sizes of computational devices continue to decrease, while increasing wireless data transfer rates and computational power make these smaller devices increasingly smarter. Advanced interactive capabilities including speech recognition, multiple-gesture interaction, augmented reality, and personal networks such as Bluetooth low energy are moving consumerism forward at a rapid pace. These advances are quickly providing highly interactive ubiquitous environments, promoting a sea change in doctor-patient interaction.

Government initiatives, such as meaningful use, are also driving consumerism forward. By way of the internet, patients are becoming more clinically informed and will undoubtedly have greater access to their personal health information. It is believed that by allowing patients to be more engaged in their health care, more informed consumers will be created, thus transforming health care into a transparent, consumer-oriented business, reducing today’s maze of intermediaries, policies, and hidden costs.

Economics

Although there have been continuous efforts to manage the cost of health care over the years, these efforts will be intensified with the passing of the Patient Protection and Affordable Care Act, ensuring health care coverage to an additional 30 million Americans [4]. And because of its high costs and increasing use, medical imaging will certainly be in the crosshairs of cost management efforts. To this end, CMS continues to decrease reimbursements, and private payers have followed suit. Managing imaging utilization has historically been conducted through such payer-centric methods as radiology benefit managers, but as accountable care organizations form and providers become responsible for the costs, clinical decision support will proliferate as a cost-effective, physician-friendly tool for managing radiology overutilization [5].

Quality

For radiologists, quality has much to do with image interpretation and the timely creation and communication of quality reports. Improved information available to radiologists at the time of interpretation, such as a patient’s pertinent clinical information via the electronic health record, is essential.

Image access is another important component of quality. Image sharing beyond the provider system is becoming more important.
Referring physicians need to have access to images beyond what is currently available in their hospitals or physician organizations; it will become imperative that image access be extended to patient care providers regardless of their physical locations or hospital affiliations. And it will become increasingly necessary to extend ownership of images to patients themselves, allowing them to share their records with whomever they choose as they travel through the care process. In this new era, communication management will become essential, and new products will appear, breaking down the existing barriers and limitations of radiologist-physician, and even radiologist-patient, interactions.

**EFFECTS ON RADIOLOGY**

We now turn to the effects these driving forces, and associated technology, will have on radiology (Fig. 1).

**New Age of Radiology**

In this new age, communication will be managed via web and mobile devices, with physicians interacting directly with radiology ordering systems, providing access to schedules, prior radiation dose exposure, prior reports and images, in-context clinical decision support, and the ability to interact seamlessly with radiologists whenever necessary. Such technology (providing clinicians with direct access to radiologists) will undoubtedly be perceived as burdensome to many. However, forward thinkers who aggressively embrace the opportunity will certainly do so as a means to maintain their clinical relevance at a time when much of our departmental technology has driven us further from the care process and overall management influence.

Images will still be stored locally in PACS, but there will be global image storage and access via cloud-based image sharing networks and health information exchanges. We will definitely see the acceleration of technologies providing image transmission outside departments and across organizations.

Image interpretation in this new age will happen through cloud-based speech recognition technology, multimedia reporting with embedded key images, and structured report elements that allow practices to measure and demonstrate quality. We will also see more clinical decision support for radiologists that offers standards-based follow-up and recommendation guidance [6].

Finally, in this new age, traditional unidirectional reporting will progress toward bidirectional mobile interaction among physicians, radiologists, and eventually patients.

**Quality and Costs Will Become Transparent**

Quality and costs will become progressively transparent. First, departments will have to expose quality metrics internally, which is already happening today. Next, transparency will rise to hospitals as organizations participate in accountable care organizations and have to demonstrate quality and the costs of running their departments. After that, data will be made available and transparent to physicians, who will be responsible for their use of cost-effective, high-quality, customer-oriented ancillary services.

And last, this process will make its way to patients, in that they will have the ability to see who is delivering the best quality of all facets of their care. As patients become more informed, active consumers in their own care, they will look for the best facilities at locations most convenient to them. And if there is a lower cost, higher quality interpretation available that is separate from the acquisition process, in the future, physicians and patients may

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**Fig 1.** Effects of imaging informatics on radiologists and health care. CAD = computer-aided detection; CDS = clinical decision support; Comm = communications; EHR = electronic health record; PHR = personal health record; RIS = radiology information system.
possibly have the ability to choose those services independent of examination acquisition.

THE ROAD AHEAD
As with all technology, “state of the art” is a fleeting title. With recent federal involvement, we are bound to see a divergence of the previous path, when we used technology to make ourselves more efficient, into using technology to demonstrate quality, manage costs, and improve patient participation.

Although adoption will likely take longer than in the consumer sector, radiology has historically been very facile and is well poised to lead the curve in health care IT, leveraging new technology and using it to our advantage. However, in this new era, that advantage may not be to make ourselves more productive in our current fee-for-service tasks but instead to improve our relevance by reasserting ourselves as the information and knowledge source in this highly interactive and ever changing digital future.

TAKE-HOME POINTS
● Radiology has historically been very facile and is well poised to lead the curve in health care IT.  
● Federal involvement is leading to a divergence of the previous path, when we used technology to make ourselves more efficient, into using technology to demonstrate quality, manage costs, and improve patient participation.
● Radiology needs to reassert itself as an information and knowledge source.

REFERENCES

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