Reengineering the Radiology Enterprise: A Summary of the 2014 Intersociety Committee Summer Conference

EC: Editor's Choice

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Abstract

The current initiative to reform health care from both a quality and a cost perspective has already had a profound impact on the radiology enterprise. We have seen a decrease in the utilization of imaging studies, a reduction in reimbursement, a declining payer mix, shrinking incomes, a proliferation of performance indices, creation of radiology mega-groups, growth of national radiology companies, and increasing turf incursions. Our cheese is clearly on the move, and we must take action to reengineer the radiology enterprise. In keeping with general health care reform, we must be patient-centric, data driven, and outcome based. We must create a radiology enterprise that adheres to the value equation of providing the highest quality health care, for the lowest possible cost, for all citizens.

Key Words: Intersociety Committee, Intersociety Committee Summer Conference, ACR, health care reform, Patient Protection and Affordable Care Act

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Established by the ACR in 1979, the Intersociety Committee (ISC) is intended to promote collegiality within radiology, foster and encourage communication among national radiology organizations, and make recommendations on areas of concern. The ISC holds an annual Summer Conference, with the topic selected by the Executive Committee. The 50-plus professional radiology organizations that are members of the ISC include diagnostic and interventional radiology, radiation oncology, and radiologic physics organizations.

The 36th ISC Summer Conference was held July 25 to 27, 2014, in Santa Fe, New Mexico. The objective of the conference was to examine the need to reengineer the radiology enterprise in the face of health care reform, learn about different techniques that could be used to facilitate change, review real-life examples of reengineering initiatives that produced major positive operational and cultural changes, brainstorm about how the radiology enterprise could be reengineered in alignment with the value equation, and learn about specific value opportunities that can be incorporated into the radiology enterprise. To provide a different perspective from which to analyze the radiology enterprise, Richard Zane MD, chair of the Department of Emergency Medicine, University of Colorado, and Derek Birzniek, chief process improvement officer, University of Colorado Health System, were invited to present how process improvement (PI) techniques were used to transform a highly congested and dysfunctional emergency department (ED) at the University of Colorado Hospital into one of the premier EDs in the country in less than 1 year. Eighty-one members and executive directors from 38 organizations participated in the conference. As in previous years, the

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conference consisted of a series of plenary presentations and work group sessions.

THE CASE FOR CHANGE

The ongoing changes in the medical landscape are driving a necessary reengineering of the radiology enterprise. Since the implementation of Medicare in 1965, national health care spending as a percentage of the gross domestic product has increased dramatically from less than 6% to more than 18%, with federal health care expenditures now accounting for 25% of the federal budget [1,2]. Through this growth, the US health care system has become the most expensive in the world; unfortunately, quality has not kept pace with expense. Using life expectancy as a proxy for the quality of health care, the United States ranks 35th internationally [3]. Evidence of the suboptimal quality of our health care can be found in two key publications, the 1999 Institute of Medicine report *To Err Is Human*, which called attention to the approximately 98,000 iatrogenic deaths that occur in our hospitals each year, and the 1999 presentation and subsequent publication *Escape Fire*, in which Donald Berwick recounted a powerful personal experience of health care gone awry during the care of his wife [4,5]. These facts and perceptions are driving a national health care reform agenda centered on improved quality and reduced cost.

The health care reform movement has already had significant impact on radiology. Recognition in early 2000 that the cost of imaging was increasing faster than other segments of health care led to the implementation of multiple rate-cutting initiatives. Starting with the Deficit Reduction Act in 2005, Medicare payments for imaging services have been cut 13 times [6]. These actions produced marked reductions in both payments for and utilization of imaging services. For example, it is estimated that payments for CT scans suffered a 20% to 23% reduction in the professional component and a 40% to 55% reduction in the technical component [7]. As for utilization, before 2005, the number of CT scans per year was increasing at a rate of 14.3%; now the increase is just 1.4% per year [7]. Overall, the impact of reductions in payment and utilization has been a 21% reduction in Medicare Part B expenditures for medical imaging between 2005 and 2010 [7]. Unfortunately, other payers have adopted many of these changes, with a growing negative impact on personal incomes for many radiologists [8].

There are many other changes that may significantly affect, or have already done so, the radiology enterprise. These include new practice models such as accountable care organizations, bundling of physician and hospital payments, consolidation of hospital systems, dramatic shifts in payer mix, and a ballooning number of value and performance-based metrics. To weather the storm, some radiology groups are merging to form mega-groups; others are becoming hospital employees. National radiology groups that offer 24/7 subspecialty reads are directly competing with local groups. Considering all of these forces, it is clear that radiology's "cheese" is on the move, and the specialty must adapt to remain relevant [9].

HOW TO CHANGE

Methods

Implementing effective change is difficult, particularly if the process is not systematic, well supported, and led by capable leaders. Large corporations and management gurus have been developing techniques to effect successful large-scale change since the 1950s [10]. Two of the most common techniques fall into the categories of process improvement (PI) and change management [11,12]. Both involve a systematic approach to help organizations optimize underlying processes to achieve improved efficiency, better quality, and greater value. Both have a demonstrated utility in the health care arena.

The most common PI techniques are Lean and Six Sigma. Lean is a production philosophy that considers any process or movement that does not directly create value or eliminate waste as disrespectful to the customer and to be eliminated [13]. Six Sigma is organized around the goal of improving the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability. Six Sigma relies on statistical methods and creates an infrastructure of people within an organization who are experts in PI ("champions," "black belts," "green belts," "yellow belts," etc). Each project carried out follows a defined sequence of steps and has quantified value targets [14].

"Change management" is an approach to transition groups or individuals from a current state to a desired future state. Multiple large companies, most notably Ford, General Electric, and AT&T, embraced change management and executed successful operational reforms [10,11,15]. Their success spawned key thought leaders such as Peter Drucker [16], whose influential publication *Management in a Time of Great Change* launched a veritable publishing frenzy on the topic. William Bridges [17] developed the Managing Transitions Model, which describes the process of change as a series of transitions from phase 1 through phase 3, with each phase having a sequential series of steps by which transition can be achieved. John Kotter [18] published an alternative 8-step process in *Leading Change*. These steps are described in more detail in the radiology case study discussed later.

Although there are many different approaches to both PI and change management, most emphasize the importance of addressing organizational culture as a key to successful change [19]. Drucker [16] emphasized this importance in

the widely quoted statement "Culture eats strategy for breakfast." He opined that culture permeates every aspect of an organization and becomes part of individuals' and groups' identities, and that to ignore culture will doom effective change.

In health care reform, one central theme has emerged; the new system must be patient-centric. To this end, system architects must build processes around the needs of patients while emphasizing quality, efficiency, reliability, and effectiveness [20]. Two significant barriers to building patient-centric models of care are a reliance on a fee-for-service reimbursement structure that rewards quantity over quality and health care providers' perception that systematized care stifles autonomy and the art of medicine [21].

Emergency Medicine Case Study

In 2012, the University of Colorado Hospital was faced with a crisis and an opportunity [22]. The existing ED, which was designed for an anticipated volume of 25,000 patients, was seeing 70,000 patients per year, and the hospital was far under capacity, causing severe "boarding of inpatients" in an already crowded ED. Every metric used to measure the efficiency of emergency care was in the worst percentile, including patients leaving without being seen, door-to-doctor time, ED length of stay, and patient satisfaction. The hospital was planning for a large expansion, which included a second inpatient tower with more inpatient rooms, intensive care units, and operating rooms and a new and significantly larger ED. Although the new ED was designed to be substantially larger and construction was well under way, there had not been any consideration of process change, including staffing. In addition, including the hallway and improvised and makeshift beds created in the old ED, the planned new ED would actually have fewer treatment areas. On the basis of anticipated volume changes, without process change, it was apparent that the new, larger ED would be over capacity in less than 1 year, essentially creating a bigger, shinier, overcrowded, dysfunctional ED. During this period of transition, the University of Colorado Hospital and University of Colorado School of Medicine recruited new emergency medicine leadership. This team was quick to recognize that to avoid transferring dysfunction, a total care redesign was required in a very short period of time: 8 months.

To achieve the change and improve processes within the ultrashort time frame, a novel approach to PI was developed, as a traditional Lean or Six Sigma project of this magnitude would take at least 3 years. The new methodology was called rapid process optimization. The goal of rapid process optimization is to use, modify, or combine the tools of existing PI methodologies to specifically and fundamentally redesign the processes of health care delivery. This was done with a complete focus on the patient as the center of the methodology. All process decisions were supported by data, and all developed concepts would be tested before execution.

With burning platform and guiding principles established, improvement teams were formed around the 3 major process buckets that exist in an ED environment. These buckets were referred to as front end, core, and back end. Teams then went about capturing current state processes, documenting tasks and roles for all positions in the ED, and gathering all available process and quality data. During this planning process, the leadership of the department was organized into dyads and triads of nursing, physician and PI or administrative leadership to lead the separate process buckets. Terms such as *physician lead* and *nursing lead* were banned, and a common leadership vernacular was accepted. The dyads and triads were charged with speaking with "one voice" and always being "data driven and patient centered."

Once the current state was defined, the teams were convened for 1-day events to design and develop a desired future state. Once a future state was documented, the teams redefined tasks and roles to the appropriate lowest cost resource and/or position, scripted work, developed care protocols, and created communication and implementation plans. Next steps included rigorous testing of concepts using computer modeling, tabletop testing, and live simulations.

New concepts developed and implemented in the process redesign included eliminating nursing triage by bringing physicians into the front-end intake process, creating a "supertrack" area for low-acuity and fast-turn patients, opening a 23-hour clinical decision observation unit, and right-jobbing by making sure that the right tasks were being done by the right roles (people). At a more basic PI level, there was the creation of standardized work and standardized care carts and room layouts and elimination of the Lean-identified 8 wastes wherever possible. In addition, the traditional waiting room was eliminated and replaced by an internal results waiting room. Whenever possible, bedside point-of-care testing replaced laboratory testing.

At 1 year after implementation, the results of the redesign are outstanding. Length of stay decreased by 40%, waiting time was eliminated with door-to-doctor time reduced to less than 15 min, patients leaving without being seen became unmeasurable (<0.5%), patient satisfaction increased dramatically, unit cost per patient was reduced significantly, and all of this occurred while remaining budget neutral and in the setting of a 35% increase in volume in 1 year [22].

Radiology Case Study

To illustrate how the principles of change management can be applied effectively in the radiology world, the following is a recounting of how a large group used a rigorous change

management pathway to implement voice recognition technology [23]. Their process closely followed the change management principles outlined by John Kotter [18] in *Leading Change*.

Step 1 in the Kotter framework is to overcome internal resistance by "creating a sense of urgency." To do so, the group discussed the frustration of its hospital administrators with report turnaround times, how patient care and service could improve with immediate signing of reports at the time of dictation, and that the group was not keeping up with other large radiology enterprises that had already adopted voice recognition. To further enhance the sense of urgency, the group invited an outside expert to provide an overview of the direction of radiology information systems and to review its present workflow. Such outside perspective, as Kotter [24] described in detail in *A Sense of Urgency*, proved to be a powerful tool to recognize the need for change.

The group then created a working group (Kotter's step 2: creating the guiding coalition), consisting of radiologists from all subspecialty sections as well as members from the IT and systems departments, to work on the project. The group appointed two tech-savvy individuals as project leaders who understood radiologist workflow and the improvements that were possible. At the same time, the practice's leadership developed a vision (step 3: developing a change vision) to be the leading provider of imaging services in its markets by adding value through improved data management and control. That vision was communicated to all physicians at multiple shareholder meetings and by the practice leaders in the reading rooms to ensure buy-in and support for the project (step 4: communicating the vision for buy-in).

To ensure that the project was successful, the work group was empowered to act (Kotter's step 5: empowering broad-based action) and given the authority to identify and select vendors, control how the system would function, and oversee rollout. The group was also given authority to work with hospital IT and radiology department personnel to ensure a smooth transition away from its old transcription systems.

After the system went live, the immediate service improvements were communicated to hospital administrators and referring physicians, who praised their success. That feedback was communicated to the radiologists to ensure that they recognized the impact of their efforts (Kotter's step 6: generating short-term wins). To maintain momentum (step 7: never letting up), a data analyst was hired to mine the data reports for value-added elements that could be reported back to the hospitals (report turnaround time, critical results, called reports, etc). Those quality reports were enthusiastically received, and that feedback was provided to the radiologists as well.

Finally, the new workflow change was incorporated into the practice's standard operations (Kotter's step 8: incorporating changes into the culture). Since the adoption of voice recognition, the group has added a number of new facilities in both its immediate service area as well as in remote locations, all with the stipulation that the group's own voice recognition system was required. No facility has declined, and all have been pleased with the results.

WHAT TO CHANGE

The attendees at the meeting were divided into 1 of 3 work groups, preimaging, imaging, and postimaging, which collectively were to encompass the majority of the clinical operational aspects of the radiology enterprise. These 3 categories were defined relative to a patient's time in an imaging facility and the corresponding work that must occur before, during, and after. Each work group was instructed to consider the scope of business that occurs during its assigned interval and how it might be improved or completely reengineered to meet the demands of health care reform.

Preimaging

The process from the time that a referring physician decides to obtain an imaging study on a patient until the time the patient arrives at an imaging facility is quite complex for advanced imaging studies. It includes the choice of the type of imaging study; consideration of the clinical appropriateness of the study and any inherent risk (such as radiation exposure); executing the ordering process (paper or electronic); coordinating the date of the study with the requesting physician, patient, and imaging facility; transmitting the relative urgency of the study; making sure appropriate clinical history is provided; identifying payment method and obtaining preauthorization from payers; arranging any necessary preimaging preparation (fasting, checking for contrast allergies, laboratory tests, providing oral contrast, etc); providing directions to the imaging facility; reminding the patient of the study; protocoling the study; providing preferred contact information for the referring physician; and providing any special management instructions. The work group reported that automation of all of these steps would be ideal. Specific ideas for improvement of the process included universal adoption of web-based scheduling for referring provider or patient, the use of patient navigators to help patients through the scheduling and preparatory process, adoption of clinical decision support (CDS) software that is directly linked to simultaneous payer approval, use of electronic medical record and computerized physician order entry systems that use hard stops and data mining to ensure that relevant clinical information always accompanies a request for imaging, development of "smart" prioritization algorithms that allow scheduling on the basis of relative urgency, and the creation of links in patient medical portals that redirect patients to the abundant educational materials available at RadiologyInfo.org.

Imaging

This work group opined that work that could be moved from the imaging segment to the preimaging segment should be maximized to minimize patient time at an imaging facility. Preimaging work should include all of the items described above as well as consent and study protocoling. The management of patients at an imaging facility should be reengineered to maximize patient satisfaction and minimize waiting time (it should be patient-centric). Waiting rooms are recognized as a universal source of patient dissatisfaction; they are often overcrowded, noisy, and dirty. The traditional waiting room should be abandoned. Patients should be scheduled to facilitate rapid movement through the imaging facility. Upon arrival, patients should move immediately from the front desk to a back staging area. Radiofrequency identification bracelets and computer tracking could be used to monitor and expedite patient flow. Facilities should adopt a fast track/slow track management system for patients and imaging studies that move at different rates through the system. Slow-track issues should not slow down the fast track; they should be taken "out of line" and handled separately. Workflow should be managed to eliminate peaks and troughs. PI techniques should be implemented to minimize errors, reduce waste, and improve the quality of care provided. To the extent possible, imaging should be located close to the point of care.

Postimaging

Work should be distributed such that it is performed by those trained to do it in the most cost-effective manner. As an example, postprocessing should be performed by technologists or image engineers, not by radiologists. This approach to work should be migrated across the radiology enterprise. The interpretation of imaging studies should be prioritized beyond stat, inpatient, and outpatient; the prioritization should be based on when the information is needed for efficient patient care (ie, clinic appointment time). Where possible, radiologists should be embedded in patient clinics to facilitate collaboration and communication. Current electronic medical record systems require significant effort to extract pertinent clinical information needed for image interpretation; they need to be enhanced to push clinical information relevant to the study being interpreted so that it is immediately available, with no search required. Standardized report templates should be universally adopted, with the incorporation of standardized macros for interpretation and management recommendations for findings. The diagnosis, impression, and opinion of the findings should be at the top of the report, rather than the bottom, for facilitated review by the referring health care provider. Radiation dose reporting should be standardized and included in reports. Reports should include relevant images, references, and links to relevant clinical information; they should be designed as actionable disease-based reports. Reports should be made available to patients after an agreed-upon embargo period that gives the referring provider time to discuss the results with the patient. Normal results may be released immediately, perhaps before the patient leaves the imaging facility. Reports should be made patient friendly and easily understood. The communication method for providing patients with their reports should be chosen by the patients (ie, phone, text, e-mail, or online portal). Radiologists should be available to speak with patients about their results, as it is imperative that radiologists become known personal health care providers.

SPECIFIC VALUE OPPORTUNITIES

The following are brief descriptions of specific value-based programs and techniques that were presented at the ISC meeting. Each is either already available or in the prototype phase. All are believed to be essential components of imaging reengineering. See the reference list for additional information.

ACR Imaging 3.0

The ACR's Imaging 3.0™ strategy promotes the many opportunities radiologists have to add value to patient care by being the primary stewards of imaging beyond just image interpretation [25]. Imaging 3.0 has 4 major components. First is a shift away from the culture of volume-driven, fee-for-service care to value-based care. Second is the provision of tools to enhance imaging care beyond interpretation. These tools, such as CDS for referring physicians, actionable reporting systems, quality metrics tools, and decision support for radiologist recommendations, are either already available or in development. Third is the empowerment of patients to be involved in their care. Last, incentives must be aligned within the entire health care system by changing the discussion in Washington and with local payers from a negotiation about more reimbursement cuts to incentives for value-based solutions that reduce costs and optimize patient care.

Radiologists Engaging and Collaborating in Healthcare

Before the widespread deployment of PACS, radiologists occupied a more traditional role as consultants. Now, with the common availability of remote viewing stations for radiologic studies throughout hospitals and clinics, that role has been eroded. To reverse this trend, researchers at Johns Hopkins Hospital have developed a tablet application, Radiologists Engaging and Collaborating in Healthcare, that integrates real-time videoconferencing with a web-based PACS viewer to digitally reinsert radiologists at the center of patient care [26]. The application allows referring physicians and patients to obtain immediate consultation with radiologists at different locations using handheld devices.

Reducing Errors

Traditionally, radiologists have viewed the prime source of error in radiology as one focused on reporting (particularly diagnostic and communicative errors). However, the sources of error in radiology are far more complex and affect every aspect of radiology operations. Radiology operations should be viewed as a value chain starting with the referring physician's choosing an imaging examination, proceeding through preauthorization, scheduling the examination, protocoling the study, patient preparation, the actual imaging, interpretation, and reporting, and ending with an actionable report communicated back to the referrer [27,28]. Radiologists must own this value chain and closely scrutinize it for the many potential sources of error. The elimination of error will yield a higher quality service and greater value for our patients.

Radiation Dose Management and Reporting

Despite ongoing debate regarding the relative risk of radiation exposure from medical imaging, public concern and appropriate stewardship have necessitated the implementation of radiation dose tracking and reportage. Indeed, some states have mandated the inclusion of dose metrics (volumetric CT dose index and dose-length product) in the physician's interpretive report [29], and The Joint Commission recently released prepublication requirements for dose tracking and reporting as part of the accreditation process for hospitals beginning in 2015 [30]. Although these metrics are not a true reflection of patient dose, they are a step in the right direction [31]. Incorporating them into radiology reports can be challenging; fortunately, open-source software tools [32,33] and a burgeoning number of commercial software solutions are available to simplify this task, as well as reporting to the ACR Dose Index Registry®.

CDS

Passage of the Protecting Access to Medicare Act in April 2014 mandates that, starting January 1, 2017, physicians ordering CT, MRI, nuclear medicine, and PET scans must consult government-approved, evidence-based appropriate use criteria through a CDS system [34]. Using the robust ACR Appropriateness Criteria, the ACR recently awarded an exclusive contract to National Decision Support Company to build and market a CDS system to third parties, including electronic health record vendors, CDS software vendors, providers, and payers [35]. This web-based platform provides direct access to ACR CDS content from electronic health records, ensuring continuous guideline updates, which are published in the Agency for Healthcare Research and Quality's National Guideline Clearinghouse. Access to the system results in a unique decision-support session number, which verifies that the ordering physician has accessed certified CDS information, functionality necessary to meet the requirements of the Protecting Access to Medicare Act [35]. The use of CDS programs should help achieve two primary aspects of the Patient Protection and Affordable Care Act, improved quality of health care and cost reduction.

Radiology Decision Support

Although much has been done to define best practices for radiology, the adoption of best practices is quite variable across the country. For example, the *New York Times* recently reported marked variability in the use of "double" CT scans (CT scans performed both with and without intravenous contrast material). Although the national average is 5.4%, some institutions administered double CT scans to 89% of their Medicare patients [36]. Although diagnostic algorithms exist, such as those developed by the ACR for the evaluation of incidental abnormalities discovered within the liver, pancreas, kidney, adrenal, adnexa, vasculature, biliary, spleen, and lymph nodes, they have not been widely adopted [37,38]. The incorporation of these algorithms in voice recognition systems for radiology report generation could help increase their use and make standardized radiologic interpretation a reality. Radiologists at the Massachusetts General Hospital found that this type of incorporation increased compliance with best practice guidelines for incidental pulmonary nodules found on abdominal CT scans from less than 50% to more than 95% [37].

Peer Review

For peer review to be effective and to result in evidence-based improvement of radiologists' performance, the current focus on diagnostic discrepancies must transition into peer-to-peer learning practices. Radiologists make mistakes and will continue to do so as technologies advance, and we need to focus on identifying, analyzing, and learning from them [38,39]. Simply collecting data but not sharing or benefiting from the lessons learned falls short of a good learning experience. It is important to share perceptual errors through constructive and nonpunitive missed-case conferences and to analyze and learn from the spectrum of interpretative mistakes we make [40].

TAKE-HOME POINTS

- Adapting to the new health care reform initiatives will require substantial reengineering of the radiology enterprise.
- The radiology enterprise must be reengineered to deliver cost-effective, patient-centric, and data-driven care.

- Specific value opportunities to improve radiology services include the ACR Imaging 3.0 program; CDS; radiation dose reduction, monitoring, and reporting; error reduction programs, effective peer review; radiology decision support; and real-time virtual consultation technology.

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