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Events That Have Shaped the Quality Movement in Radiology

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As radiology responds to escalating clinical demands, tightening regulations, and rapidly advancing technologies, there is an ever increasing need for quality methodologies to improve competitiveness and patient safety. Quality in radiology is defined as “a timely access to and delivery of integrated and appropriate radiological studies and interventions in a safe and responsive facility and a prompt delivery of accurately interpreted reports by capable personnel in an efficient, effective, and sustainable manner” [1]. We have categorized the forces that have shaped the quality movement into internal leadership initiatives, adverse events, and external regulations.

THE INSTITUTE OF MEDICINE’S 2000 REPORT *TO ERR IS HUMAN* (EXTERNAL REGULATION)

Until 2000, medical errors were generally unknown to mainstream providers, administrators, patients, and policymakers [2]. Events were considered an inevitable by-product of modern medicine or the unfortunate consequence of bad providers [2]. The modern interpretation of medical quality emerged in 2000 with the Institute of Medicine’s report *To Err Is Human* [3], which redefined adverse events as principally failures in system-based processes and moved the responsibility for patient safety away from dedicated patient safety specialists, charging everyone with the responsibility for patient safety.

To Err is Human [3] represents the dawn of the quality movement in radiology, capturing unprecedented public and media attention. The report shocked the nation with its staggering figure of 44,000 to 98,000 annual deaths secondary to preventable medical errors, making it the eighth leading cause of death, ahead of breast cancer, acquired immune deficiency syndrome, and motor vehicle accidents. It raised public awareness of the prevalence of medical errors and their preventable nature. The problem, as the report pointed out, resided in faulty systems, not individual actions. The prevention of medical errors requires dramatic system wide changes, for which a 4-tiered approach strategy was proposed to create financial and regulatory incentives: (1) create a national center for patient safety, (2) develop nationwide mandatory and voluntary reporting systems, (3) raise the standards for patient safety, and (4) build a culture of safety. A direct result was the announcement of new

standards on patient safety from the Joint Commission and a consensus report by the National Quality Forum [4,5].

THE ABR'S 2002 ADDITION OF THE PRACTICE QUALITY IMPROVEMENT REQUIREMENT FOR MAINTENANCE OF CERTIFICATION (INTERNAL LEADERSHIP INITIATIVE)

The ABR mandates that each radiologist demonstrate commitment to practice quality improvement (PQI) and competence in clinical practice by conducting a PQI project during the 10-year maintenance-of-certification cycle [6]. Each PQI project must be relevant, must be achievable in practice, must affect PQI, and must produce results suitable for repeated measurements over the 10-year cycle [6]. Five categories of PQI projects were specified: patient safety, accuracy of interpretation, report turnaround time, practice guidelines, and technical standards and referring physician surveys. This is a national imperative to improve quality and safety in radiology.

THE 2005 ACR SUN VALLEY GROUP WHITE PAPER (INTERNAL LEADERSHIP INITIATIVE)

This meeting of 16 key figures and selected authors in quality literature represents the first nationwide discussion of quality in radiology to formulate a strategy to promote PQI initiatives within our community. Four main themes were (1) share approaches and data from various PQI programs in radiology, (2) analyze current and future pay-for-performance systems, (3) develop programs and future initiatives of the ACR and international radiology societies, and (4) search for health service research methods to develop quality metrics [1]. Consequent to this meeting, pilot educational programs were developed and hosted at the subsequent Sun Valley Group meetings for all radiologists interested in implementing PQI programs within their practices.

THE FDA'S 2006 ALERT ON THE RISK FOR NEPHROGENIC SYSTEMIC FIBROSIS FROM GADOLINIUM (EXTERNAL REGULATION)

On the basis of cases reported by the Danish Health Authority, the FDA first notified the public about the risk for NSF from gadolinium-containing contrast agents [7]. A general FDA warning was issued against the use of gadolinium contrast agents in patients with moderate to severe chronic renal insufficiency and in all patients with acute renal insufficiency [7]. An exception was made for cases in which the diagnostic information was essential and unavailable with non-contrast MRI. Subsequently, the manufacturers of gadolinium contrast agents were required to revise their products' labels to include a new boxed warning and a new section about the risk for NSF [8]. Numerous scientific studies and research series have been published on the topic, leading to ACR guidelines for creatinine testing in certain patient populations and a significant decrease in the incidence of NSF [9,10]. This has transformed the daily practice of radiology.

THE JOINT COMMISSION'S 2008 ONGOING PROFESSIONAL PRACTICE EVALUATION (EXTERNAL REGULATION)

Since 2008, the ongoing professional practice evaluation has been part of the Joint Commission's evaluation standards of each medical staff across all departments and services [11]. The evaluation features 6 general core competencies: patient care, medical and clinical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. It defines the responsibility for and frequency of data review, data incorporation into credentials, and consequent actions if necessary. It is designed to assess clinical competence and professional behavior on an ongoing basis to provide more timely feedback and an opportunity to improve performance on a timely basis.

CT RADIATION OVEREXPOSURE AT MAD RIVER COMMUNITY HOSPITAL IN 2008 AND AT CEDARS-SINAI HOSPITAL IN 2009 (ADVERSE EVENTS)

On January 23, 2008, a 2.5-year-old boy was brought to the Mad River Community Hospital ER in Arcata, California, after minor neck trauma, for which a cervical spine CT was done. He was mistakenly scanned 151 times for 68 minutes, resulting in a massive radiation overdose and immediate erythema [12]. However, the hospital failed to report this overdose incident to the California Department of Public Health as required. The cause of the event was reportedly a combination of human error and equipment failure. Similarly, at Cedars-Sinai Hospital in Los Angeles, up to 260 patients undergoing CT brain perfusion imaging received up to 8 times the normal radiation dose because of erroneous scanner settings [13]. The incident was followed by a class-action lawsuit against the hospital and equipment manufacturer for a lack of radiation safety measures. These incidents of radiation overexposure escalated public concern for radiation safety, resulting in subsequent statewide legislation changes to require the documentation of radiation dose on CT images and in patients' medical records [14].

CALIFORNIA'S 2010 RADIATION CONTROL LAW (EXTERNAL REGULATION)

This legislation is a direct response to several radiation overexposure incidents in California in 2008 and 2009. Effective July 1, 2012, it requires all CT scanners to receive accreditation by CMS by January 1, 2013, as well as annual verification for equipment calibration [14]. Under this law, hospitals and clinics using CT equipment for clinical examinations will be required to record accumulative radiation doses on CT images and in patients' medical records. These facilities are also obligated to report any overdoses to the California Department of Public Health, the patient, and the ordering physician. Overdose is clearly defined as a radiation dose exceeding 20% of what is intended. In short, the radiation control law is a landmark legislative case in radiation safety with profound effects on the daily practice of radiology.

THE 2008 IMAGE GENTLY® AND 2010 IMAGE WISELY™ CAMPAIGNS (INTERNAL LEADERSHIP INITIATIVES)

Responding to increasing public concern of excessive medical radiation, Image Gently is an initiative of the Alliance for Radiation Safety in Pediatric Imaging to protect the most vulnerable patient population [15]. It translates the concept of ALARA into practical guidelines, including low-dose CT and fluoroscopic protocols and training modules for health care professionals [15]. Advocacy for radiation safety was further strengthened by the creation of the Image Wisely campaign in 2010 by the ACR, the RSNA, the American Society of Radiologic Technologists, and the American Association of Physicists in Medicine [16]. Its objective is to eliminate unnecessary procedures and reduce radiation dose in medically necessary imaging in adults [16]. CT protocols were modified to minimize dose, as demonstrated in the development of adaptive iterative reconstruction, which reduces image noise while maintaining spatial resolution [16]. Together, both campaigns signify ongoing success and efforts to improve safety and the quality of care in radiology.

CONCLUSIONS

The combination of these recent adverse events, internal leadership initiatives, and external regulatory forces has transformed the quality movement in radiology in the past decade. Other sentinel events (such as a 2004 Virginia Mason Medical Center mislabeling incident) have also shaped the quality movement but did not capture the same level of public attention as the events described above. Most recently, quality in radiology has been driven by escalating public concern for medical radiation, particularly from CT imaging. An important goal of quality movement efforts is to encourage physician involvement to foster self-regulation and spearhead future policies. The successful Image Gently and Image Wisely campaigns are demonstrations of recent nationwide efforts to promote the highest quality of patient care and safety in radiology.

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