Building Imaging Institutes of Patient Care Outcomes: Imaging as a Nidus for Innovation in Clinical Care, Research, and Education

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Traditionally, radiologists have been responsible for the protocol of imaging studies, imaging acquisition, supervision of imaging technologists, and interpretation and reporting of imaging findings. In this article, we outline how radiology needs to change and adapt to a role of providing value-based, integrated health-care delivery. We believe that the way to best serve our specialty and our patients is to undertake a fundamental paradigm shift in how we practice. We describe the need for imaging institutes centered on disease entities (eg, lung cancer, multiple sclerosis) to not only optimize clinical care and patient outcomes, but also spur the development of a new educational focus, which will increase opportunities for medical trainees and other health professionals. These institutes will also serve as unique environments for testing and implementing new technologies and for generating new ideas for research and health-care delivery. We propose that the imaging institutes focus on how imaging practices—including new innovations—improve patient care outcomes within a specific disease framework. These institutes will allow our specialty to lead patient care, provide the necessary infrastructure for state-of-the art-education of trainees, and stimulate innovative and clinically relevant research.

Key Words: Patient-centered care; Diagnostic imaging; Diffusion of innovation; Quality of health care; Medical education.

INTRODUCTION

Within the field of medicine, there are significant pressures to improve patient outcomes and reduce costs (1). This became increasingly clear under the Affordable Care Act and has formed the nidus of heated discussions when contemplating alternative health-care funding policies (2,3). The practice of radiology traditionally has been focused on volume as opposed to added utility, patient outcomes, or other well-defined metrics (4). As such, radiology is particularly affected by a shift to a more value-based health-care model (5).

It is unrealistic for the radiology community to respond to health-care delivery pressures and health-care legislative reform with small alterations to practice structure, cost-cutting initiatives, or simply just "working harder." We believe that this is a unique opportunity for the radiology community to capitalize on imaging's central role in directing clinical care and to assume a leading role in establishing biomarker-based institutes that focus on patient care outcomes.

Generally speaking, radiologists—and perhaps pathologists—have the fewest financial incentives in patient treatment algorithms. They are therefore uniquely positioned to lead such institutes without risking bias, for example, toward surgical or medical therapies. Although many initiatives for clinical excellence currently exist across academic institutions and major tertiary referral centers, radiologists tend to be participants rather than leaders in such initiatives. Furthermore, these initiatives tend to be purely clinical, are usually dependent on individual expertise rather than systems, and lack a substantial research and education branch.

Perhaps most significantly, our practices tend to be test- or radiologist-centric, focusing on sensitivity, test accuracy, or turn-around times (6). Instead, we propose that our practices should be patient- or disease-centric, focusing on the metrics that are most important to patients and disease-specific mortality and morbidity (7,8). Imaging institutes offer the opportunity for novel approaches to improve health care, using the best current evidence—of test accuracy and comparative effectiveness, cost, and patient preference—to ensure that patients get the right test at the right time and follow-up imaging if applicable. For example, added utility of a new magnetic resonance sequence in the evaluation of patients with cognitive impairment would be much easier in the setting of an imaging-based institute focused on the role of imaging in clinical care,

Acad Radiol 2018; 25:594–598

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https://doi.org/10.1016/j.acra.2018.01.009

research, and education for cognitive impairment or dementia. In the same setting, a new algorithm in the care of these patients, with imaging-based decision-making would again be readily implemented or tested. Imaging institutes would also strengthen the link between imaging information, physician decision-making, and therapy, thereby improving patient outcomes. The American College of Radiology (ACR) appropriateness criteria provide a good foundation for these imaging institutes as they are disease- or clinical indication-centric and can provide the nidus for development of further infrastructure or patient-centered imaging institutes. Imaging institutes will allow radiology practice to incorporate the well-established model for proving efficacy of diagnostic test from the technology assessment level to the patient outcome level (9) and allow technical innovation and patient outcome metrics to evolve concurrently in a dynamic setting.

The purpose of our manuscript is to outline a potential scheme for placing imaging at the center of patient care and using that role to enhance research and education efforts. Imaging institutes are a proposed model for integrating patient care, education, and research in a more comprehensive fashion and can exist within the infrastructure provided by existing academic radiology departments and service lines. The scope of imaging institutes is more far reaching than existing definitions of centers of excellence in that it aims to integrate education and research with patient care as well as extend to use metrics that are more patient- and clinical outcome-centric as opposed to radiology or clinician-centric.

Research

The academic radiology field is uniquely positioned to create a much-needed paradigm shift by establishing imaging institutes. Academic departments have three aspects to their mission: clinical care, research, and education, all of which are critical to the implementation of the imaging institute paradigm. In addition to those benefits noted earlier, imaging institutes also offer the opportunity to build data infrastructure and improve analytic methods. Such institutes can improve patient- and disease-centered research by making efficient use of existing resources, such as patient registry studies (eg, ACR-based registries; https://www.acr.org/Research/Clinical-Research), and conducting adaptive and pragmatic trials applicable to real-world clinical practice (10).

Imaging institutes will not only optimize clinical care and patient outcomes; they will also spur the development of a new educational focus, which will increase opportunities for medical trainees and other health professionals (11). These institutes will also serve as unique environments for testing and implementing new technologies, furthering imaging biomarker development and for generating new ideas for research and health-care delivery (12). We propose that the imaging institutes focus on how imaging practices—including new innovations—improve patient care outcomes within a specific disease framework and solidify the concept of evidence-based practice (13,14). These institutes will allow radiologists to take a leading role in imaging-based research from technology assessment to imaging-related patient outcomes.

Innovation—Do We Need to Change the Paradigm?

Innovation can be generally defined as new technologies or practices and processes that bring about improvement of services or outcomes (15). Traditionally, this definition has held true in radiology, a field in which technical advances in imaging have been credited with some of clinical practice's most significant changes. Imaging innovations have undoubtedly transformed medical care. Abdominal computed tomography (CT) has replaced exploratory laparotomy. 18F-fluorodeoxyglucose positron emission tomography CT imaging examinations are used to stage and follow up patients with a range of malignancies. Brain magnetic resonance imaging has become an essential tool for the diagnosis and follow-up of patients with multiple sclerosis (16,17).

In a business model, "disruptive" innovation creates growth and profits, by creating a new market and providing a different set of values which is usually lower priced and overtakes an existing set of values (18). However, in medical practice, there are relatively fixed resources. Therefore medical innovation—particularly technical innovation—creates growth, but can also result in increased cost rather than profit (19). Technical innovation will continue to expand imaging opportunities and technical innovation has progressed rapidly in areas of medicine such as device development where financial reimbursement incentives are in place. However, we must figure out how to best implement these innovations to add value to the patient and improve outcomes, rather than saddling them with increased costs due to more expensive testing (8). Although imaging technical innovations have become an integral part of medical practice, furthering innovation within radiology is increasingly challenging, as alterations in processes are more complex endeavors involving multiple facets of medical practice.

Current Practices and Need for a Shift

Traditionally, radiologists have been responsible for the protocol of imaging studies, imaging acquisition, supervision of imaging technologists, and interpretation and reporting of imaging findings. There has been increased subspecialization in the field, with many radiology trainees acquiring additional skills through fellowships, although more than 50% of practicing radiologists do work that spans multiple subspecialties (20). Radiologists in larger and academic practices tend to practice within their primary subspecialty and that is part of the reason academic centers are equipped to implement the paradigm of imaging institutes, which would require subspecialty radiologists to function effectively (21,22). Increased specialization has also resulted in the development of more focused, innovative imaging protocols. These new protocols optimize diagnostic capabilities without, however, necessarily paying equal attention to the value added to patient care. More