Training for the Future of Radiology: A Report of the 2005 Intersociety Conference

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The field of radiology has expanded dramatically and now encompasses a broad range of imaging examinations and image guided procedures. These imaging technologies are powerful tools which provide valuable information, and combining modalities further enhances their value. The changes our imaging technologies have brought bring into question our training methods, especially the value of the clinical year prior to entering radiology. As the quality of our health care systems is being challenged, demonstration of both quality processes and outcomes are needed. Maintenance of Certification, which demonstrates continuing learning and practice improvement, has become an important part of a radiologist's quality credentials.

Key Words: Transitional year, radiology residency, radiology fellowships, radiology research, radiology quality

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Established by the ACR in 1979, the Intersociety Conference is intended to promote collegiality within radiology, foster and encourage communication among national radiology societies, and make recommendations on areas of concern. The subject of each meeting is selected by its executive committee. The 53 professional radiology societies that participate in the Intersociety Conference include both diagnostic and interventional radiology, radiation oncology, and radiologic physics.

The Intersociety Conference met July 22 to 24, 2005, in Jackson Hole, Wyo, to discuss how to best design training programs to meet the needs of the future. Eighty-eight members and executive directors participated in the conference.

EXPANSION OF RADIOLOGY

Advances in technology have resulted in imaging equipment capable of providing a wealth of diagnostic information not available a generation earlier. This has had a profound effect not only on the practice of radiology, radiation oncology, and radiologic physics but also on the entire field of medicine. Exploratory laparotomies have been replaced with diagnostic abdominal computed tomography (CT) examinations. Surgery is performed only if a CT examination reveals an abnormality amenable to surgical correction. Increasingly, these and other "operations" are no longer performed in operating rooms but in angiography suites under image guidance. Radiation oncologists must use information from cross-sectional imaging examinations, especially CT, to optimize treatment planning. Radiologic physicists and other imaging scientists now subspecialize in radiography, CT, ultrasound, magnetic resonance (MR), or nuclear medicine physics. There is so much information available that no one person can master the entire field [1]. Furthermore, the rate at which we are acquiring new information is increasing, which is adding to this pressure to subspecialize.

As residency training programs developed and formalized after World War II, 3 years were required for radiology. With increases in medical knowledge and the beginning of subspecialization, the radiology residency was divided into either diagnostic radiology or radiation oncology in 1969. In 1984, the length of the residency was increased from 3 to 4 years. By 1990, all residency training programs were required to have at least 1 person responsible for the educational programs in each of the 9 subspecialty areas [2]. Recognition of the need to acquire even more information and procedural skills led to fel-

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lowship training programs, and most radiology residents now take 1 or more years of fellowship training before entering either academic or private practice [3,4].

The trend toward increasing subspecialization is continuing. Neuroradiologists focus on spinal, pediatric, interventional, or head and neck radiology. Interventional radiologists may concentrate on vascular procedures, nonvascular intervention, or oncologic procedures such as percutaneous tumor ablation or chemoembolization. Thoracic radiologists are often divided into those who provide cardiac imaging and those limiting their practice to the lungs and mediastinum. Although this degree of subspecialization or focus of practice is usually found in academic settings, private practice groups are increasingly appreciating the value in having this high level of expertise within their groups. The underlying theme is that our field has become so complex that no one individual can maintain the level of expertise needed to practice the entire field of radiology. Because no one practices the entire field, why do we insist that radiologists become at least "minimally competent" in the entire field? With more than 30,000 biomedical journals and more than 17,000 new books published each year [5], maintaining the fund of knowledge and skills needed to remain current as technology and treatments evolve is very challenging. Indeed, it is virtually impossible today to remain a general radiologist with competence in all areas of our specialty.

FUSION IMAGING

Diagnostic radiology is not the only discipline facing this pressure to either subspecialize or lengthen the training period. Nuclear medicine physicians recognize the added value of "positron emission tomography/CT" examinations over conventional positron emission tomographic studies [6,7]. This success has led to the development of "single photon-emission computed tomography/CT" scanners, which offer similar advantages over conventional gamma cameras [8]. Thus, rather than restrict the scope of their practice to exclude these fusion modalities, the American Board of Nuclear Medicine has decided to extend the current 2-year residency program to 3 years. This change will affect residents entering their residencies in July 2007.

TRAINING PROGRAMS MUST CHANGE

A clinical year is required before a physician can enter a radiology residency training program. Typically, this is done as a transitional year, and the program selected is at a community hospital located near either the medical school from which the student graduated or the residency program at which he or she will train. A minimal number of call nights, a modest intensity of daytime work responsibilities, and a variety of other trainee benefits are major considerations in the selection of the program [9]. This type of clinical year does little to enhance a trainee's understanding of disease pathophysiology or of how radiology contributes to patient care. In an era of general radiology, such a program may be useful, but it has little value in today's practice.

The 4 years of training in a radiology residency are excellent. Residents follow a curriculum that includes the entire field, and they do a remarkable job of learning both the process of radiology and factual material. At the conclusion of the residency, they take an oral examination in 11 different categories. This examination is designed to ensure basic competence, though few residents would be judged to have mastered each category.

Most graduating residents then take 1 or more years of fellowship training in the areas in which they intend to practice. Those entering academic practice restrict their practice to a single area, though related areas may be included to improve flexibility and staffing efficiency. Those entering private practice have a broader range of practice. The added value of fellowship training is appreciated by groups, and challenging cases are brought to those with this additional expertise. The quality of practice of an entire group is improved by these fellowship-trained radiologists.

Fellowship training is needed to gain deeper knowledge, new techniques, and practical experience to provide this high level of clinical service. However, it is not enough to learn the material during training. New information, techniques, and technology continue to be generated such that learning must be a lifelong process, and radiologists must continue to perform large volumes of studies and maintain high levels of practice.

The technical demands for procedural skills and familiarity with new devices means that only a few members of a group can develop the expertise to practice interventional radiology. The Mammography Quality Standards Act requires that physicians practicing mammography interpret a minimum number of cases and attain specific breast-related continuing medical education to continue to practice [10]. New protocols and types of examinations expand with developing technology, especially in CT and MR imaging and spectroscopy. The emergence of fusion imaging presents further challenges to staying abreast of this evolving technology.

As the field of radiology expands, the degree of subspecialization required to maintain competence increases. Our residency training programs are appropriate for the practice of general radiology, something that is vanishing today. A change in our training programs is needed to prepare radiologists for tomorrow's practice.

INTERPRETATION MUST BE APPROPRIATE

A radiology report should identify abnormalities, include likely diagnostic possibilities, and suggest further imaging examinations, if needed. These latter 2 components of a radiology report require the integration of the imaging findings with the patient's clinical setting and therapeutic options. The report must be more than technically accurate; it must be appropriate to the clinical setting. The importance of informatics and then integration of clinical with imaging databases cannot be overestimated. Understanding what a referring physician needs to know to take care of a patient is the purpose of the clinical experience. Yet in an era of subspecialization, the transitional year has little relevance. This clinical experience should be focused in the area in which a radiologist will practice and would be more appropriately embedded in the fellowship than required before entering radiology.

PLACEMENT OF CLINICAL EXPERIENCE

Although the mandatory clinical year before entering radiology was a good idea when first instituted years ago, it has become superfluous as radiology has become more clinically oriented and residents now get clinical training through direct involvement in interventional procedures and subsequent management of their patients. A better alternative to the current transitional year is an integrated residency and fellowship. The first 3 years could constitute a core curriculum, during which training in all aspects of diagnostic radiology would be provided. This would be followed by a 3-year or 3-year "focused" program, which would replace the traditional fellowship and could include clinical training. During the fellowship, each resident would be required to focus on 1 or perhaps 2 subspecialty areas. A variety of choices would be available, depending on an individual's interest. In some academic radiology departments with particularly strong research programs, a 3-year fellowship could be created, with the focused portion of the program containing a research year in addition to the 2 years of subspecialty radiology and clinical training.

There are major advantages to this new structure. First, it would counteract the tendency among residents to go directly into private practice without the benefit of fellowship training. When this happens on a large scale, the degree of subspecialty expertise within the broad radiology community is diminished, and a "dumbing-down" process occurs. A lack of subspecialty expertise among radiologists is not only bad for patient care but also reduces the respect radiologists are accorded by their colleagues in other medical disciplines. For example, an experienced neurologist or orthopedic surgeon is unlikely to rely on a diagnosis made on an MR study by a radiologist who has had only 3 to 4 months of training in neuroradiology or musculoskeletal imaging. This lack of confidence in radiologists would force them to rely on their own interpretations.

Another advantage of this new training structure is that it would enhance the amount and quality of radiology research. Those residents at academic centers that provide a research year would become better trained and more involved in research methodology. Even in those programs that offered 2 years of focused training, instead of 3, residents would be more likely to get involved in research because they would be spending their time in the subspecialty areas in which they were most interested and in which they will spend the largest amount of their clinical practice. As a result of these developments, it is possible that more residents would be attracted to careers in academic radiology, thereby helping alleviate the manpower shortages now facing many academic departments [11].

The structure of the American Board of Radiology (ABR) examination should also be changed. Residents are obsessed with "boards mania" during much of their fourth year. This prevents them from taking advantage of the learning opportunities offered by their programs, learning to be effective practicing radiologists, and acquiring more sophisticated skills. Radiology is currently the only medical specialty that gives its certifying examination during the residency period [9]. We should consider postponing our certifying examination to at least 1 year after the completion of training. This too would help academic departments recruit junior faculty members, because graduating residents might be inclined to stay in teaching environments before their board examinations. An alternative approach would be to combine the current written and oral examinations into a single computerized examination that includes images and is organized into multiple modules. Instead of taking the entire examination at a single time, residents would be given the option of taking one or several modules at a time, spaced throughout their fourth year. This would create a more relaxed atmosphere during the fourth year and allow residents to learn to be good practitioners of their field, instead of frantically focusing all their energies on passing a test.

CARDIOVASCULAR RADIOLOGY: AN EXAMPLE OF THE CHANGING NEEDS FOR TRAINING IN RADIOLOGY

Discussions about the structure of the residency program and the board examinations were a prelude to an in-depth discussion of training needs in cardiovascular imaging (CVI), one of the areas that is evolving most rapidly. Radiologists have drifted away from this field over

the past 3 decades, as cardiologists have progressively displaced them from cardiac angiography and echocardiography and encroached on cardiac nuclear imaging. However, recent advances in CT and MR of the heart and blood vessels have reawakened radiologists' interests. Radiologists are the only specialists who receive significant training in the physics, imaging technology, and operational aspects of CT and MR scanners. Both the ACR [11] and the American College of Cardiology [12] have developed training standards for cardiac CT and MR. Although the standards are similar, cardiologists will not attain the technical expertise that radiologists achieve in the use of CT and MR during their years of training. On the other hand, radiologists need to make sure they are adequately trained in cardiac anatomy and physiology as well as the clinical aspects of cardiovascular disease.

There are a number of steps that could be taken to improve the training of both residents and practicing radiologists in cardiovascular disease and CVI. These steps require concerted efforts by different segments of the radiology community. Major societies, especially the ACR, the American Roentgen Ray Society, and the Radiological Society of North America, have the financial and educational resources to support training in CVI. They can sponsor courses and workshops at various locations around the country. A smaller organization, such as the North American Society for Cardiac Imaging or the Society for Thoracic Radiology, can help greatly by developing teaching materials, planning courses, and making its members' expertise available, but such organizations do not have the financial resources to support large-scale training activities and must rely on larger radiology organizations.

Another approach is for academic radiology departments that already have cardiac centers of excellence to develop preceptorships. Radiologists from other institutions can come to these centers for periods of intense training under the tutelage of experts. Still another approach is through distance learning, wherein teaching materials related to CVI are made available on Web sites.

Other steps involve radiology residency programs. A core curriculum in CVI should be developed that meets the training standards of both the ACR [13] and the American College of Cardiology [14]. Each residency program needs to ensure that one or more faculty members have expertise in cardiac CT, cardiac MR, and nuclear cardiac imaging. The faculty members who would most likely become experts in CVI would come from the thoracic or interventional radiology sections but may include faculty members subspecializing in MR, CT, or nuclear medicine. The training of faculty members could be achieved through regional courses, preceptorships, or distance learning.

If the ABR were to make CVI a formal and distinct section of the board examination, residents would be more motivated to learn the material. The ABR has created a "virtual" cardiac category in the oral examination by including CVI material that already exists in the thoracic, vascular, pediatric, and nuclear medicine categories. However, this does not put enough emphasis on cardiac imaging. Moreover, the examiners in those other categories may not always be comfortable with the cardiac content and may ask superficial questions or accept incomplete answers from the candidates. Having a dedicated CVI section on the oral board examination with dedicated cardiovascular examiners would demonstrate credibility with our clinical colleagues, as well as with our own residents. Most important, it would help stimulate residents to become better prepared for clinical practice in this vital and rapidly advancing field.

AN IMPROVED TRAINING PROGRAM

Substantial changes are needed in the way we train radiology residents if we are to meet the needs of future radiologists. As new knowledge is created, we cannot merely add more years of training to gain these additional skills [1]. Instead, we must restructure the entire program to provide a general knowledge of the field as a basis for more specialized training during fellowship.

To learn and retain the knowledge and skills needed, radiologists must focus their practice rather than try to cover the entire field. Although this is happening naturally among practicing radiologists, we have not yet adjusted our training programs to reflect this reality.

The residency training curriculum is designed to allow residents to learn the information they need to practice each area at a basic level of competence. Residents appreciate the need for additional training, and most take fellowships in the areas in which they intend to practice. However, the effort required to gain "competency" in the areas in which they will not practice is largely wasted.

Thus, residency training should be reduced to 3 years, with shorter rotations on each subspecialty area. These will be designed to give residents knowledge of the area, not mastery. These 3 years will be followed by a mandatory 2-year or 3-year fellowship, which will include clinical training and research experience in those programs with strong research programs. Even those residents who intend to go into private practice should benefit from a better understanding of how research is conducted.

Understanding how an imaging study or image-guided intervention fits into the patient care protocol is essential to becoming an effective radiologist. The clinical year taken as a transitional year before entering radiology is not accomplishing this goal. The clinical experience must be taken with those subspecialty physicians

Table 1. Radiology training program

Current	Proposed
Transitional year	
4-year residency	3-year residency
1-year fellowship	3-year fellowship[a]
Total 6 years	Total 6 years

[a]Includes focused clinical and research training.

practicing in the area of a radiologist's subspecialty interest.

Currently, medical students take 6 or more years of training before entering practice, either academic or private practice (Table 1). This new training proposal would also require 6 years. There are 2 differences: first, the clinical experience would be taken in a field pertinent to the intended practice domain, and second, the subspecialty radiology training would be focused on an area or areas of radiology that could be more thoroughly mastered.

LIFELONG LEARNING

Few radiologists continue to practice only those things they learned as residents and on which they were examined at the completion of their training. These lifetime certificates have little relevance to the practice of radiology if they are more than 10 years old. In recognition of this, the American Board of Medical Specialties (ABMS) has mandated that each of its 24 member boards offer only time-limited certification.

In 1973, the ABMS and its member boards adopted the policy of recertification. In 1993, the policy was reaffirmed to require all boards to establish plans to recertify diplomates, and in 2000, each of the member boards of the ABMS committed to evolve its recertification program into a program of the maintenance of certification (MOC). Diagnostic radiology began this requirement in 1995 with the subspecialty certifications. The MOC process is meant to move from periodic examination as a measure of competence to self-assessment and improvement throughout one's professional career.

The ABMS and its specialty boards do not require the recertification of diplomates with lifetime certificates. They request that these individuals voluntarily participate in the MOC process to ensure continuing competence. There is a growing consensus among many consumers, health care purchasers and payers, and government health care organizations for public measurements of physicians' practice performance. States may require the documentation of MOC activities to maintain medical licensure. Consumers want measures of quality to be readily available to help guide them to quality medical care [15]. One method available to radiologists now is enrollment in an MOC program.

The MOC program mandated by the ABMS and developed by the ABR is designed to reflect this diversity of practice by allowing each participant to select those areas pertinent to his or her practice. The 4 components of the MOC program are (1) professional standing, (2) lifelong learning and self-assessment, (3) practice performance, and (4) a cognitive examination [16].

Maintenance of certification is a set of concepts in evolution that will change as the ABMS and other oversight groups revise their policies. These policymaking groups want to create more measurable quality indicators that can be used to assess the performance of both individual physicians and physician groups. Currently, validated quality measures (such as the Health Plan Employer Data and Information Set) exist for general clinicians but are not yet available for many specialties [17]. Many large employers and third-party payers want a set of quality indicators with which to monitor the performance of health care providers. They believe that improved quality will diminish costs and are willing to offer financial incentives to reward quality practices through "pay-for-performance" programs. One such group, the Integrated Healthcare Association in California, has created quality measures for primary care physicians to pay bonuses for "quality" health care [18]. Other groups and insurers plan to develop quality measures for medical specialties, including radiology. Highmark [19] of Pennsylvania says,

> From a payer perspective, we're starting to look at what the indicators would be for specialists. First we are going to try to get the indicators out there, and let them see how they're being measured. We intend to do that in 2006 but will probably hold off on tying a bonus to their performance until they get used to being measured.

Compared with the burden of providing quality data for pay for performance, the MOC process is relatively easy. We must demonstrate to outside policymakers that we are maintaining our professional skills and providing quality imaging. Organized radiology will need to be proactive in demonstrating our commitment to quality, including the development of quality indicators that are reasonable and measurable for practicing radiologists.

CERTIFICATION BY MODULES

The current system of completing all board examinations by the end of residency training encourages memorization and "cramming" for the examinations. Although a high level of factual information is learned, it will not be retained if it is not used on a regular basis. The MOC process could be segmented into smaller learning modules with immediate testing at the end of each completed self-assessment module (SAM). The modules would be

interactive to provide feedback on performance and links to knowledge that the test revealed to be limited. This example of approaching the cognitive examination as more periodic "nibbles" rather than one "big bite" may reduce the anxiety physicians have in participating in the MOC process.

CENTRAL SAM REPOSITORY

Although there is strong support for MOC, a central SAM directory would help participating radiologists find the SAMs they need. These SAMs would encompass those from radiology societies, meetings, and clinical specialties of interest to radiologists. The repository would not only list available SAMs as a menu for radiologists but would also track the completion of SAMs, analogous to a continuing medical education repository.

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