An Opportunity for Radiology

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Core Tenets of Radiology

- Tradition
- Domain of Expertise
  - Clinical
  - Technological
  - Cost-Effectiveness
- Dedication
  - Quality
  - Safety
  - Patient Care

Strengths of Radiology

- Clinical Acumen
- Mastery of Technology
- Quality and Safety

Clinical Acumen

- Radiology attracts best and brightest
- Full-time devotion to imaging procedures
- Image interpretation is a learned skill
- Difficult to quantify
- Subject to challenge

Technology Mastery

- Challenge of selecting the best technology
- Complexity of data acquisition
- Complexity of image presentation
- Complexity of the acquisition/display interface
- Challenge of storing, retrieving and distributing images

Quality and Safety

- Displaying optimal images for interpretation
- Minimizing procedural costs
- Reducing risk and assuring safety
- Improving procedures through CQI
- Documenting and demonstrating quality
- Inter-relationship of technology, quality and safety

Quality Requirements for the Radiologist

- Recognize what's needed
- Program the technology to acquire it
- Manage the technology/patient interface
- Pre- and post- process the information
- Recognize distortions and artifacts
- Interpret images quickly and accurately
- Correlate findings with other information
- Communicate interpretation
- Manage and store information

Challenges to Radiology

- Clinical demand
- Lowered reimbursements
- Personnel shortages
- Technological complexity
- Dependence on referrals
- Intrusion of other specialties (self referral)

Bottom Line Conclusion

- Clinical Acumen
- Quality of Images
- Safety of Patients
- Cost Effectiveness of Procedures

CANNOT BE MAINTAINED WITHOUT

- Mastery of Technology

But Mastery of the Technology Requires

UNDERSTANDING THE UNDERLYING PHYSICS

AND

USING THIS UNDERSTANDING IN TECHNOLOGY APPLICATIONS

What Does Understanding the Underlying Physics Mean?

"If you want to teach me how to drive a truck, don't tell me how to build a motor."

University of New Mexico resident

Indicators of How Well Radiologists Understand Physics

- Resident selection criteria
- Physics learning process during residency
- Attitudes towards physics education (residents, attendings, program directors, physicists)
- Performance on certification exams
- General recognition of inadequate understanding of physics

Reasons for These Indicators

- Discomfort with quantitative sciences
- Demands of clinical services
- Pressure to produce more work
- Fewer persons to do the work
- Expansion of imaging capabilities
- Overwhelming complexity of the technology
- Quality and structure of physics teaching
- Relevance of the certification examination
- Ease of passing the certification examination

What Must be Examined to Change These Indicators?

- Resident selection criteria
- The learning process for physics during residency
- Active support for the learning process in the department
- What and how physics is taught
- The physics certification process for radiologists
- Incorporation of physics and technology mastery into the MOC process

This Examination is the Purpose of the January 20th Educational Forum

- Think
  - Globally
  - Deeply
  - Thoughtfully
  - Constructively
  - Objectively
- Listen carefully
- Focus on solutions
- Help meet the challenge
  - And capitalize on the opportunity

Purpose of the Forum

The purpose of the Forum is to develop a strategy to improve the physics and engineering education and expertise of specialists in each of the three disciplines represented at the Forum. The science and technology employed by these disciplines is rapidly becoming more complex and more integrated, and there is every reason to believe that this trend will continue well into the future. For several reasons the education of residents and physics students is not keeping pace with this trend. In addition, radiologists, medical physicists and radiation oncologists in practice are struggling to keep pace with the evolving technology and complexity of their disciplines. A new strategy is required to educate residents and practitioners in the physics and engineering (or "technology') of their disciplines. The development of this strategy, including its conceptualization and the details of its deployment, is the purpose of this forum.

Forum Participants

ACGME – RRC	A^3CR^2
AAPM	ABMP
ABR	ACMP
ACR	APCR
APDR	ARRO
ARRS	ASTRO
AUR	CCMP
COMP	EFOMP
ICTP	RSNA

Forum Conclusions: Objectives of Physics Education in Radiology

- Identify knowledge needed
- Teach (learn) needed knowledge
- Meet regulatory requirements
- Examine taught knowledge
- Sustain and update knowledge

Forum Conclusions: Linking Teaching and Testing

- Physicists and radiologists agree on curriculum
- Physics emphasis by ACGME/RRC
- Tie curriculum to certification
- Ensure curriculum and certification clinically relevant
- Develop examination blueprint
- Place residents on committees
- Rethink examination schedule
- Develop SAMS
- Improve communication

Forum Conclusions: Challenges to Physicists

- Do they have the knowledge?
- Can they teach?
- Can they be taught to teach?
- Do they have time to teach?
- Are there incentives to teach?
- Can they teach at the “teachable moment”?
- Can supplemental materials improve teaching?

Forum Conclusions: Challenges to Chairs/Program Directors

- Emphasize importance of physics
- Pay for physics support
- Schedule time to teach
- Encourage/require participation
- Ensure expectations are met
- Endorse tag-team teaching
- Provide resources

Forum Conclusions: Challenges to Residents

- Recognize importance of physics
- Study to understand, not just to pass
- Move beyond reviews as knowledge resources
- Participate in teaching/learning sessions
- Help to correct what is inadequate

Radiology Physics Examination - American Board of Radiology

Mid-1930s:	Oral examination
Mid-1970s:	Written examination in physics
	Oral examination for those who flunk
Mid-189s:	Written examination only
	Beginning 4th year
1999:	Written examination only
	As early as beginning 2nd year
200_:	Next step in the process

Consequences of the 1999 ABR Action

- Perception that physics is a hurdle
- Residents have too little clinical experience
- No expansion of physics teaching in first year
- Precipitous decline in exam performance
- Some programs stopped teaching physics altogether

Correction of the Consequences

- Objective scoring of physics examination
- Elevating score required to pass
- Rethink examination schedule
- Correlate certification examination with curriculum
- Seek input of persons taking examination
- Restructure examination in its entirely

Proposal: A Two-Phase Approach to ABR Physics Certification

Phase I: Year 1

- Teach fundamental physics
- Satisfy didactic regulatory requirements
- Establish physics foundation
- Emphasize clinical context
- Exam as early as fall year 02
- Web-based, or at testing centers

Proposal: A Two-Phase Approach to ABR Physics Certification

Phase II: Years 2-4

- Teach modality-specific physics applications
- Use teachable moments during clinical rotations
- Integrate physics with acquisition clinical skills
- Utilize those who can and will teach
- Compile and develop web-based educational materials
- Solicit assistance of professional organizations
- Consider educational materials as SAMS

Proposal: A Two-Phase Approach to ABR Physics Certification

Phase II: Years 2-4 (continued)

- Include self-tests in SAMS
- Require completion of self-tests
- Include contextual physics questions on clinical written exam
- Include contextual physics questions on oral exam
- Emphasize importance of physics teaching to physicists
- Reward good physics teaching wherever it is found

Recommendations

- Consider the scientific and engineering credentials of applicants to residency programs in radiology as indicative of their interest and ability to master the science and technology of their future discipline; (APDR)

Recommendations

- Physicists and radiologists should work together under the aegis of the American Association of Physicists in Medicine (AAPM) to identify the breadth and depth of core knowledge necessary for radiologists to competently practice their discipline; (AAPM)

Recommendations

- The AAPM and the American Board of Radiology (ABR) should work with regulatory agencies such as the Nuclear Regulatory Commission to ensure that the identified core knowledge encompasses the education and training required to be recognized as a qualified expert by the agencies; (ABR)

Recommendations

- Accreditation of residency programs by the Accreditation Council on Graduate Medical Education-Residency Review Committee (ACGME-RRC) should include examination of the quality and extent of physics education during residency; (ACGME-RRC)

Recommendations

- The physics certification examination offered by the ABR should be clinically relevant, reflect the AAPM curriculum for physics education of radiology residents identified above, emphasize problem-solving, work backwards from images to principles where possible, be transparent in terms of the core knowledge that will be tested on the examination, and include a substantial number of questions on magnetic resonance imaging, multi-array computed tomography, positron emission tomography, and other state-of-the-art imaging technologies; (ABR)

Recommendations

- Communication among the AAPM, ABR, and ACGME-RRC should be dramatically improved so that residents and physics instructors understand what is to be taught, what is to be learned, and what is to be examined concerning the physics foundation of radiology; (AAPM-ABR-ACGME-RRC)

Recommendations

- Radiologists who have recently passed the written physics examination should be invited to participate in the development of the AAPM physics curriculum for educating radiologists, and in the development of the ABR physics examination to test the core knowledge expressed in the curriculum; (AAPM - ABR)

Recommendations

- The ABR examination schedule in physics should be examined to identify the most logical time(s) and process(es) to administer the examination, probably including asking applied physics questions during the clinical written and oral examinations of radiologists; (ABR)

Recommendations

- Physicists should recognize that too often physics is taught in an unsatisfactory manner by physicists who do not have the knowledge or incentive to be good teachers, and that this problem must be addressed in those programs where it arises if the current problems of inadequate physics instruction and knowledge of residents is to be addressed satisfactorily; (AAPM)

Recommendations

- In residency programs where there is interest, physicists and radiologists teaching physics together in a tag-team format should be explored; (APDR)

Recommendations

- Web-based educational modules should be accessible to facilitate "just-in-time" and "point-of-care" education of residents about the physics of specific technologies as residents encounter those technologies in the clinical setting; (RSNA – ACR – AAPM)

Recommendations

- The cost of preparing peer-reviewed, web-based educational modules should be covered by professional organizations such as the Radiological Society of North America and the American College of Radiology, potentially with the assistance of funds from corporate sponsors; (RSNA – ACR)

Recommendations

- Physics must be understood by radiologists, radiology residents, and medical physicists as essential knowledge to the competent and compassionate use of imaging technologies in the care of patients. (APDR – AUR – ACGME- RRC)

Conclusions

- Radiology is at a crossroads of opportunity
  - Technology is expanding
  - Applications from molecular to system levels
  - Imaging as a data-management tool
- This crossroad can be traversed successfully by sustaining radiology's commitment to:
  - Clinical acumen
  - Technology mastery
  - Quality, safety, and cost-effectiveness

But these commitments can only be met if the physics underlying radiology is clearly understood and applied.

Educational Summit: Day 2 Physics Education of Medical Physicists

Educational Summit: Day 2 Physics Education of Medical Physicists

General Findings

- Several disconnects exist in the education of medical physicists
- Medical physicists have few accountability standards
- No required linkage between education, residency, accreditation and certification
- Few restrictions on entry pathways into discipline
- Communication among organizations (AAPM, ACMP, CAMPEP, ABR, etc) is insufficient
- Education, skill-development, accreditation and certification of medical physicists needs alignment

Educational Summit: Day 2
Physics Education of Medical Physicists

Education and Training

- Core knowledge and clinical skills of medical physicists should be agreed upon
- Curriculum should be developed that reflects the core knowledge and skills
- CAMPEP and ABR should reflect the curriculum in accreditation and certification
- Curriculum should accommodate knowledge/experience required by regulatory agencies
- Admissions criteria into medical physics should reflect input of professional organizations

Educational Summit: Day 2
Physics Education of Medical Physicists

Residency Programs

- Funding is major limitation
  - Institutional support
  - CMS support
  - Organizational support
  - Students self-support

Educational Summit: Day 2
Physics Education of Medical Physicists

Teaching

- Time is a growing limitation
  - Research commitment
  - Clinical services
  - Promotional criteria
  - Institutional recognition
- Web-based educational aids
- Emerging and existing technologies must be taught
- Students should learn How to Teach
- Feasibility of a ScD degree in medical physics

Educational Summit: Day 2
Physics Education of Medical Physicists

Accreditation

- Argument over accrediting single-pathway programs
- Development and accreditation of hub-and-spoke residency programs
- Need for additional financial support for CAMPEP
  - Sponsor support of CAMPEP
  - Additional sponsoring organizations
  - Annual fee charged to accredited institutions
- Linkage of education, accreditation, certification and MOC
- Admission standards for certification should reflect accreditation
- Alternative pathway(s) into discipline should (must?) be developed

Educational Summit: Day 2
Physics Education of Medical Physicists

Certification

- Link eligibility for certification to completion of accredited program (or CAMPEP-approved alternative pathway)
- 2012 as an unofficial ABR goal
- Admissions standards into ABR certification should be clarified
- NRC "deemed status" should be obtained by ABR
- Importance of certification should be emphasized to AHA, JCAHO, etc
- ABR should solicit greater input from practicing physicists

Recommendations

- Communication channels should be established and employed to facilitate ongoing discussion among the AAPM, ACMP, CAMPEP, ABR and other interested organizations concerning the educational pathway in medical physics, encompassing graduate education, residency training, accreditation and certification. (Lead organization AAPM)

Recommendations

- The core knowledge and skills needed for a medical physicist to practice competently in a clinical setting need to be defined and promulgated by medical physics organizations (Lead organization AAPM)

Recommendations

- One or more alternative pathways to completion of a CAMPEP-approved graduate or residency program need to be defined in terms of candidate eligibility and standards of performance (Lead organization CAMPEP)

Recommendations

- Additional residency positions in medical physics should be developed, and funding sources for these positions should be identified (Lead organization ACMP)

Recommendations

- Increased financial and staff support for CAMPEP should be solicited from accredited institutions and current and additional sponsoring organizations (Lead organization CAMPEP)

Recommendations

- Training requirements of regulatory agencies (e.g., NRC, FDA, state health departments) should be identified and disseminated to directors of graduate and residency programs in medical physics (Lead organization AAPM)

Recommendations

- Web-based educational materials pertinent to medical physics education and training should be compiled with active links from a single web site (Lead organization RSNA)

Recommendations

- Accreditation and certification should be linked at an appropriate date (2012?) so that only candidates completing a CAMPEP-accredited graduate or residency program, or a CAMPEP-approved alternative pathway, will be admissible to the ABR certification examination (Lead organization ABR)

Recommendations

- The ABR should work with the NRC to achieve "deemed status" for its certification processes for medical physicists (Lead organization ABR)

Recommendations

- The certification categories of the ABR should be examined to determine if they are optimal, and to decide if the Medical Nuclear Physics certification category should be altered (Lead organization ABR)

Recommendations

- Organizations such as the AHA and the JCAHO should be encouraged to recognize the importance of certification of medical physicists providing clinical services (Lead organization ABR)

Recommendations

- Additional input from practicing medical physicists into the ABR written and oral examinations of medical physicists should be solicited (Lead organization ABR)

Recommendations

- Special concerns of Canadian physics organizations about the ABR certification process should be examined (Lead organization CCPM)

Educational Summit: Day 2
Physics Education of Medical Physicists

Participants

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