Expectations of Physics Knowledge for ABR Certification of Radiologic Physicists

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Topics for Presentation/Discussion

- Theme of the Educational Forum
- Forces Shaping the Expectations for Medical Physics Knowledge
- Educational Training Position Statements
- Overview of the ABR Certification Exam for Radiologic Physics
- Eligibility Requirements
- Linking Accreditation and Certification in Medical Physics
- Psychometric aspects of the ABR Certification Exam Process
- Item Statistics and Performance Indicators
- Passing Score Statistics
- After Primary Certification – Maintenance of Certification

Theme of the Educational Forum:
"A Time of Opportunity for Medical Physicists"

- Expanding contributions in the key areas of: Clinical service; Research; and Education.
- Expectation: That the Board certification process would focus on evaluating minimum qualifications/credentials for clinical service and education in a meaningful way.
- Challenge: To ensure that the certification process appropriately evaluates the state of preparedness for the professional roads ahead.

Mission Statement
of the
American Board of Radiology

The Mission of The American Board of Radiology is to serve the public and the medical profession by certifying that its diplomates have acquired, demonstrated and maintained a requisite standard of knowledge, skill and understanding essential to the practice of radiology, radiation oncology and radiologic physics.

Forces that Shape the Expectations for Medical Physics Knowledge - Internal

Medical physics profession's self-vision for medical physics knowledge.

- CAMPEP: Objectives are the review and accreditation of educational programs in medical physics.
- AAPM Committees and Task Groups
- ACR – Guidelines and Technical Standards
- ACMP – Scope of Practice of Medical Physics (Feb 2002)

Forces that Shape the Expectations for Medical Physics Knowledge - External

Medical physics training programs influenced by requirements imposed by ‘outside’ organizations.

- State Departments of Health
- FDA – eg., MQSA
- NRC – Requirements for Recognized Status

Forces that Shape the Expectations for Medical Physics Knowledge - External

NRC – Requirements for Recognized Status

- At issue: Diplomates certified by the ABR will automatically have fulfilled the training requirements for radiation safety officer and authorized medical physicist.
- NRC qualification statement: Individual "is certified by a specialty board whose certification process has been recognized by the Commission….."
- The process: "The names of board certifications which have been recognized by the Commission or an Agreement State will be posted on the NRC's web page. To have its certification process recognized, a specialty board shall require all candidates for certification to:……"

Educational Training – Position Statements

- Professional organizations within the discipline of medical physics (i.e., the “industry”) should define the scope of the educational requirements for medical physicists.

- The ABR should be responsive to the vision of the “industry” and construct an examination process that reflects this vision under the constraints of valid/established testing criteria and strategies.

Overview: The ABR Certification Examination for Radiologic Physics

- Part 1: a.) General: Basic radiologic physics
  b.) Clinical: Clinical aspects of RP
- Part 2: Specific to the area of qualification: Diagnostic RP, Therapeutic RP, Medical Nuclear Physics.
- Oral Exam: Specific to the area of qualification
  Five broad categories of questions.
  1.) Protection/patient safety, 2.) Patient related measurements, 3.) Image acquisition and processing, 4.) Calibration and quality assurance 5.) Equipment

Eligibility Requirements – Part 1

- Specialist by education, training and experience in one or more fields of radiologic physics.
- Bachelor's degree in physics or applied physics from an approved/accredited institution. Other physical science or engineering degree may be considered if appropriate physics courses taken; and
- Masters or doctorate degree from an approved/accredited institution in medical physics, radiologic physics, health physics, physics, or other relevant physical science or engineering discipline.

Note: Part 1 may be taken prior to graduate degree if enrolled in a CAMPEP-accredited medical physics graduate program.

Eligibility Requirements – Part 2 & Oral

Part 2:

- Must have passed Part 1(within the past 7 years)
- Must have had at least 36 months of full-time active association (training) with an approved department or division in the areas in which certification is sought. (Some credit may be received for a completed graduate degree program if it included a clinical component.)

  Note: Practical training must have been under the supervision of an ABR-certified radiologic physicist.

Oral Examination:

- Must have passed Part 1 and Part 2.

Linking Accreditation & Certification in Medical Physics

Reference: WR Hendee. JACR 2:198-199, 2005

- **Issue:** Should certification be restricted to graduates from CAMPEP-accredited programs?
- **Positive aspects:** Standardization of the quality of medical physics education; Produce a higher level quality of patient care; Address the issue of accountability – both professional and public.
- **Goal:** 2012 – Eligibility for ABR certification requires graduation from a CAMPEP-accredited medical physics graduate program or residency.

Psychometric Aspects of the ABR Examination Process (1)

ABR Division of Psychometric and Testing Services
Anthony Gerdeman, Ph.D., Division Chair

Numerous variables taken into account before setting the passing standard ("cut-score")

Angoff Procedure: A panel of experts evaluates each question by rating how well a hypothetical candidate whose knowledge is "just sufficient and acceptable" (minimally competent) would perform on each question. Allows for consideration of the differences in difficulty of questions that comprise the exam each year. The most widely used/accepted process for setting passing scores. Provides guidance and a reference for establishing the cut-score.

Psychometric Aspects of the ABR Examination Process (2)

- **Validity and Reliability of the Standard (cut-score):**

  Established per the many variables used including the expert judgment and various statistical analyses. Also confirmed by independent testing organizations that have evaluated the ABR exams.

- **Characteristics/Attributes of the Standard:**

  May vary from year to year due due to variation in item difficulty and the composition of the candidate group. No maximum/minimum fail rates.

- **Future Directions:**

  Continue to evaluate the appropriateness and impact of the cut-score level. Should the bar be raised?

Item Statistics & Performance Indicators

- **Difficulty (p-value):** Proportion of candidates answering item correctly. The higher the p-value, the easier the item. Ideally, $0.40 < p < 0.90$.
- **Discrimination (pbis):** Point-biserial correlation of candidates' scores on the item and the total test performance for that item: Range –1.00 to +1.00. Positive values indicate item discriminates in favor of the upper (higher scoring) examinee group.

  Ideally, correlation of 0.1 or higher preferred.
- **Reliability (KR-20):** Indicator of the overall test-retest consistency (reliability). High value means that on multiple repeat tests with these exams, we would reach the same conclusions about the candidates level of ability each time. Good > 0.8; Very Good > 0.9.

Passing Score Statistics and Trends: Part 1 - General

Year	Fail Rate	Ave Item Difficulty	Ave Item Discrim	Reliability (KR-20)
2005	23%	0.66	0.39	0.99
2004	21%	0.63	0.38	0.98
2003	18%	0.57	0.38	0.99
2002	17%	0.55	0.51	0.99
2001	14%	0.54	0.43	0.97
2000	18%	0.55	0.36	0.91

Passing Score Statistics and Trends: Part 1 - Clinical

Year	Fail Rate	Ave Item Difficulty	Ave Item Discrim	Reliability (KR-20)
2005	20%	0.73	0.39	0.86
2004	16%	0.65	0.31	0.81
2003	18%	0.66	0.32	0.81
2002	14%	0.64	0.45	0.83
2001	12%	0.64	0.38	0.73
2000	12%	0.65	0.30	0.78

Passing Score Statistics and Trends: Part 2 - Therapy

Year	Fail Rate	Ave Item Difficulty	Ave Item Discrim	Reliability (KR-20)
2005	27%	0.66	0.29	0.96
2004	24%	0.51	0.30	0.97
2003	25%	0.53	0.26	0.95
2002	19%	0.52	0.37	0.97
2001	21%	0.54	0.39	0.96
2000	29%	0.52	0.29	0.85

Passing Score Statistics and Trends: Part 2 - Diagnostic

Year	Fail Rate	Ave Item Difficulty	Ave Item Discrim	Reliability (KR-20)
2005	33%	0.65		0.99
2004	30%	0.58		0.96
2003	30%	0.59		0.99
2002	21%	0.62		0.98
2001	30%	0.50		0.96
2000	29%	0.52		0.89

Passing Score Statistics and Trends: Part 2 – Medical Nuclear

Year	Fail Rate	Ave Item Difficulty	Ave Item Discrim	Reliability (KR-20)
2005	43%	0.48		0.94
2004	38%	0.57		0.94
2003	46%	0.46		0.95
2002	42%	0.47		0.94
2001	46%	0.50		0.88
2000	63%	0.50		0.83

Passing Score Statistics and Trends: Oral Examination

Year	Pass Rate	Conditioned Rate	Fail Rate
2005	59%	13%	28%
2004	51%	12%	37%
2003	48%	16%	36%
2002	64%	11%	25%
2001	62%	16%	22%
2000	45%	18%	37%

After the Primary Certification - Maintenance of Certification (MOC)

- **Proposition:** The commitment to maintain competency in the chosen disciplines of medical physics should be mandatory both to satisfy the public trust and as a matter of professional responsibility.
- **Expectation:** Medical physics training programs will be preparing their graduates for participation in the ABR MOC program components including lifelong learning, self-assessment, cognitive exam, and practice performance evaluation.

Summary Statements

- The ABR has specific expectations of physics knowledge for certification in radiologic physics as reflected in eligibility requirements and exam content.

- The ABR will continue to monitor the effectiveness of the certification exam process to ensure that its mission is accomplished: That is, “To serve the public and the medical profession by certifying that its diplomates have acquired, demonstrated and maintained a requisite standard of knowledge, skill and understanding essential to the practice of radiology, radiation oncology and radiologic physics.”