Medical physicist

Background

According to the American College of Medical Physics (ACMP), the practice of medical physics is the use of principles and accepted protocols to ensure the correct quality, quantity, and placement of radiation during the performance of a radiological procedure. Proper medical physics practice may include the actual performance of the activities or the establishment and supervision of the activities under appropriate circumstances.

Medical physicists are practitioners who are competent to practice independently in the field(s) of medical physics in which they are certified and, when appropriate, hold state licensure. They are responsible for ensuring the optimum use of radiation to produce a stated diagnostic or therapeutic outcome. Their responsibilities include the following:

- Protection of the patient and others from potentially harmful or excessive radiation
- Establishment of adequate protocols to ensure accurate patient dosimetry
- Measurement and characterization of radiation
- Specification of dose delivered
- Development and direction of quality assurance programs
- Assistance to practitioners in optimizing the balance between the beneficial and deleterious effects of radiation

The American Board of Radiology (ABR) certifies medical physicists in the following traditional fields of medical physics:

- Diagnostic radiologic physics, which deals with the diagnostic applications of x and gamma rays, ultrasound, and radiofrequency radiation, and the equipment and methods for image acquisition, processing, and display
- Therapeutic radiologic physics, which deals with the therapeutic applications of x and gamma rays, charged particles, neutrons, and other forms of radiation, and the radiation sources, equipment and methods for planning, simulating, and delivering therapeutic radiation
Medical physicists may also specialize in medical health physics, which deals with the following:

- The safe use of x-rays, gamma rays, electron and other charged particle beams of neutrons or radionuclides, and of radiation from sealed radionuclide sources for both diagnostic and therapeutic purposes, except with regard to the application of radiation to patients for diagnostic or therapeutic purposes

- The instrumentation required to perform appropriate radiation surveys

**Involved specialties**

Medical physicists and doctors of medicine, osteopathy, podiatry, dentistry, or chiropractic who prescribe or utilize radiological procedures

**Positions of societies and academies**

The ACMP publishes *Scope of Practice of Medical Physics* in which the ACMP says that the standards it generates are practice-guiding principles for qualified medical physicists. They are designed to support them in the achievement of quality patient care. Standards may be exceeded in a particular practice situation or for an individual patient, depending on patient need and available resources.

These standards should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed toward obtaining the same results. The ultimate judgment regarding the propriety of any specific procedure or course of conduct must be made by the qualified medical physicist in light of all circumstances presented by the individual situation. Adherence to standards will not necessarily assure a successful outcome in every situation. It is prudent, however, to document the rationale for any deviation from applicable standards in the facility’s policies and procedures manual or in the patient’s medical record.

In regard to medical physicist qualifications, the ACMP says the primary qualification for the practice of medical physics is certification in the appropriate subfield by the American Board of Medical Physics (ABMP), the ABR, the Canadian College of Physicists in Medicine, or the American Board of Science in Nuclear Medicine. In the case of mammography physics, although lesser qualifications are acceptable under federal law,
medical physics subfield and state licensure, in those states in which licensure exists, are the appropriate qualifications for the designation of a qualified medical physicist. Certification by the American Board of Health Physics is an acceptable qualification for the practice of medical health physics.

AAPM The American Association of Physicists in Medicine (AAPM) states that medical physics is an applied branch of physics concerned with the application of the concepts and methods of physics to the diagnosis and treatment of human disease. It is allied with medical electronics, bioengineering, and health physics.

The role of the medical physicist is to contribute to the effectiveness of radiological imaging procedures by ensuring radiation safety and helping to develop improved imaging techniques (e.g., mammography, computed tomography, magnetic resonance, ultrasound). They contribute to development of therapeutic techniques (e.g., prostate implants, stereotactic radiosurgery), collaborate with radiation oncologists to design treatment plans, and monitor equipment and procedures to ensure that cancer patients receive the prescribed dose of radiation to the correct location.

Most medical physicists have an MS or PhD in medical physics, physics, radiation biology, or a related discipline, and training in clinical medical physics. Clinical training may be obtained through a residency traineeship or a postdoctoral program of one or two years in a hospital. Clinical medical physicists are employed in medical schools, hospitals, or clinics, or are in private practice. These physicists divide their time between clinical service and consultation, research and development, and teaching. Some medical physicists work in industrial or research positions, and have no clinical responsibilities.

Positions of other interested parties

ABR The ABR grants a certificate to applicants who have been found qualified to practice in one of the following fields of radiologic physics.

General qualifications

- Diagnostic radiologic physics
- Therapeutic radiologic physics
- Medical nuclear physics
Applicants for certification are required to present evidence that they have the appropriate general qualifications and special training. In addition, they must pass an ABR written and oral examination.

Applicants must have the following general qualifications:

- Be a specialist by education, training, and experience in one or more fields of radiologic physics. The application for examination must be limited to the field(s) in which the candidate is a specialist.

- Hold a bachelor’s degree in physics or applied physics from an approved institution. Other physical science or engineering degrees may be considered if applicants have completed the appropriate fundamental courses within physics.

- Hold a master’s or doctoral degree from an approved institution accredited by a regional accrediting body in medical physics, physics, or other relevant physical science or engineering disciplines. An experimental master’s or doctorate thesis with laboratory experience is preferred. Significant experience in experimental physics at the graduate level in an approved academic institution or on-the-job experience under the supervision of a qualified preceptor are acceptable alternatives.

- Have completed formal course work in the biological sciences including enough general biology, anatomy, physiology, oncology, and radiobiology for the candidate to be able to understand and participate in clinical discussions.

Special training

Applicants must have completed at least three years of full-time active association with an approved department or division of the subfield in which certification is sought. The three years may be partially acquired by experience associated with graduate study in an approved medical physics program, which includes a clinical component. The usual credit is six months for a master’s programs and 12 months for doctoral programs. Full time credit will be given for experience gained through approved postgraduate clinical medical physics internship or residence programs, and clinical postdoctoral programs.

For candidates in medical nuclear physics, all or part of the required special training may be gained by active participation in a medical nuclear program sponsored by a department other than a department of radiology or radiation oncology. To
receive credit for special training in this circumstance, the major portion of the medical nuclear program must comprise diagnostic and therapeutic procedures on patients.

**Written examination**

Currently the AVR written examination is divided into two parts. Part one is further subdivided into a section on general physics related to all specialties, and a clinical section covering general clinical concepts that should be familiar to the practicing radiologic physicist.

Part two of the examination consists of three exams, one in each of three fields of radiologic physics.

**Oral examination**

The oral examination is designed to test the knowledge and fitness of applicants to practice applied radiologic physics in the field(s) for which they have applied. Applicants must have passed part one and part two of the written examination to be admissible to the oral examination. Those who are taking the exam in more than one field of radiologic physics are required to take a full oral exam in each field.

Applicants are examined in the five physics categories of the examination. These categories are

- radiation protection and patient safety
- patient-related measurements
- image acquisition, processing, and display
- calibration, quality control, and quality assurance
- equipment

The ABR states that a certificate granted by the board does not confer any degree or legal qualifications, privileges, or license to practice radiologic physics. It is understood that a certificate in any category of radiologic physics qualifies the physicist to act in an advisory capacity to physicians regarding the physical aspects of radiation therapy, radiologic diagnosis/nuclear medicine. A certificate in radiologic physics does not qualify its holder to practice any phase of clinical radiology.

**ABMP**

The ABMP entered into a working agreement with the ABR in 2001. Under the terms of the agreement, the ABMP will no
longer offer certification examinations in the traditional fields of medical physics to new candidates. Traditional fields of medical physics include radiation therapy physics (therapeutic radiological physics), diagnostic imaging physics (diagnostic radiological physics), and nuclear medicine physics (medical nuclear physics).

The ABMP will continue to exist and continue to offer recertification to its diplomats. The ABMP has had a positive impact on the quality of the medical physics certification process and will continue that tradition. The ABMP has also pioneered new, nontraditional fields of medical physics certification including magnetic resonance imaging physics, medical health physics, and hyperthermia physics. The ABMP will continue to certify in these fields and intends to develop new examinations in emerging subspecialties. These may include cardiovascular brachytherapy, stereotactic radiosurgery physics, and others deemed important by the medical physics community.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has no formal position on the delineation of privileges in medical physics. However, in regard to qualifications for medical physicists, hospitals must comply with the following human resources (HR) and leadership (LD) standards from the 2004 Comprehensive Accreditation Manual for Hospitals:

- **LD.3.70**—The leaders define the required qualifications and competence of those staff who provide care, treatment, and services and recommend a sufficient number of qualified and competent staff to provide care, treatment, and services

- **HR.1.10**—The organization provides an adequate number and mix of staff consistent with the organization’s staffing plan

- **HR.1.20**—The organization has a process to ensure that a person’s qualifications are consistent with his or her job responsibilities

- **HR.2.10**—Orientation provides initial job training and information

- **HR.2.20**—Staff members, licensed independent practitioners, students, and volunteers can describe or demonstrate their roles and responsibilities, based on specific job duties or responsibilities, relative to safety

- **HR.2.30**—Ongoing education, including inservices, training,
and other activities, maintains and improves competence

- HR.3.10—Competence to perform job responsibilities is assessed, demonstrated, and maintained

- HR.3.20—The organization periodically conducts performance evaluations

CRC draft criteria

An organization should not wait until it receives a request for an application for clinical privileges from a medical physicist to consider whether it wishes to grant privileges to this type of practitioner. The policy governing medical physicists should be drafted ahead of time by the organization and should consider the needs of the community and medical staff, and the hospital’s mission and strategic plan. In addition, the organization should review federal and state laws, and state and local licensing requirements.

Criteria should be in place covering qualifications, scope of practice, and physician supervisory requirements. The criteria and process for granting privileges to medical physicists should be outlined in an appropriate document.

The qualifications of the medical physicist and delineation of clinical privileges must be set forth either in a job description or through the medical staff membership process in the appropriate category.

The following draft criteria are intended to serve solely as a starting point for the development of an institution’s policy regarding this practice area.

**Minimum threshold criteria for requesting core privileges in medical physics**

- **Basic education**: MS or PhD
- **Minimum formal training**: Applicants must be certified by the ABR, the ABMP, or by an equivalent body in the field of medical physics in which they are seeking privileges. In addition, applicants must hold licensure, where required.
- **Required previous experience**: Applicants must be able to demonstrate that they have performed in the past 12 months at least 50 procedures in the field of medical physics in which they are seeking privileges.

**References**

A letter of reference must come from the director of the applicant’s medical physics training program. Or a letter of reference regarding competence must come from the chief of medical
Core privileges in medical physics include but are not limited to the following:

- **Diagnostic radiological physics**
  - Evaluation of radiological imaging procedures prior to clinical use
  - Development/evaluation of policies and procedures related to the appropriate clinical use of radiation for imaging purposes
  - Development and management of a comprehensive quality management program that monitors and evaluates critical imaging equipment and processes
  - Review of diagnostic imaging dosimetry information noted in patient records
  - Consultation on patient or personnel radiation dose and associated risks

- **Therapeutic radiological physics**
  - Evaluation of radiation oncology technical procedures prior to clinical use
  - Development/evaluation of policies and procedures related to the appropriate therapeutic use of radiation
  - Review of radiation oncology dosimetry information noted in patient records
  - Development and management of a comprehensive quality management program that monitors and evaluates critical radiation oncology equipment and processes
  - Consultation on patient or personnel radiation dose and associated risks

- **Medical nuclear physics**
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- Evaluation of nuclear imaging and radioactivity measurement procedures prior to clinical use

- Development/evaluation of policies and procedures related to the appropriate clinical use of radiation for nuclear imaging/radioactivity measurement purposes

- Review of radiopharmaceutical dosimetry information noted in patient records

- Development and management of a comprehensive quality management program that monitors and evaluates critical nuclear imaging and radioactivity measurement equipment and processes

- Development/evaluation of a comprehensive clinical radiation safety program in nuclear medicine

- Consultation on patient or personnel radiation dose and associated risks

**Reappointment**

Reappointment should be based on unbiased, objective results of care according to the organization’s existing quality assurance mechanisms.

Applicants must be able to demonstrate that they have maintained competence by showing evidence that they have performed annually over the reappointment cycle at least 50 procedures in the field of medical physics in which they are seeking privileges.

In addition, continuing education related to medical physics should be required.

**For more information**

For more information regarding this practice area, contact:

American Association of Physicists in Medicine
One Physics Ellipse
College Park, MD 20740
Telephone: 301/209-3350
Fax: 301/209-0862
Web site: aapm.org
American Board of Medical Physics
C/O Credentialing Services, Inc.
P.O. Box 1498
Galesburg, IL 61401
Telephone: 309/343-1202
Fax: 309/344-1715
Web site: www.acmp.org/abmp

American Board of Radiology
5441 East Williams Boulevard, Suite 200
Tucson, AZ 85711
Telephone: 520/790-2900
Fax: 520/790-3200
Web site: www.theabr.org

American College of Medical Physics
12100 Sunset Hills Road, Suite 130
Reston, VA 20190-5202
Telephone: 703/481-5001
Fax: 703/435-4390
Web site: www.acmp.org

Joint Commission on Accreditation of Healthcare Organizations
One Renaissance Boulevard
Oakbrook Terrace, IL 60181
Telephone: 630/792-5000
Fax: 630/792-5005
Web site: www.jcaho.org
Privilege request form
Medical physicist

In order to be eligible to request clinical privileges in medical physics, an applicant must meet the following minimum threshold criteria:

- **Basic education:** MS or PhD
- **Minimum formal training:** Applicants must be certified by the ABR, the ABMP, or by an equivalent body in the field of medical physics in which they are seeking privileges. In addition, applicants must hold licensure, where required.
- **Required previous experience:** Applicants must be able to demonstrate that they have performed in the past 12 months at least 50 procedures in the field of medical physics in which they are seeking privileges.
- **References:** A letter of reference must come from the director of the applicant’s medical physics training program. Or a letter of reference regarding competence must come from the chief of medical physics at the institution where the applicant most recently practiced.
- **Core privileges:** Core privileges in medical physics include but are not limited to the following:
  - **Diagnostic radiological physics**
    - Evaluation of radiological imaging procedures prior to clinical use
    - Development/evaluation of policies and procedures related to the appropriate clinical use of radiation for imaging purposes
    - Development and management of a comprehensive quality management program that monitors and evaluates critical imaging equipment and processes
    - Review of diagnostic imaging dosimetry information noted in patient record Consultation on patient or personnel radiation dose and associated risks
  - **Therapeutic radiological physics**
    - Evaluation of radiation oncology technical procedures prior to clinical use
    - Development/evaluation of policies and procedures related to the appropriate therapeutic use of radiation
    - Review of radiation oncology dosimetry information noted in patient records
    - Development and management of a comprehensive quality management program that monitors and evaluates critical radiation oncology equipment and processes
    - Consultation on patient or personnel radiation dose and associated risks
  - **Medical nuclear physics**
    - Evaluation of nuclear imaging and radioactivity measurement procedures prior to clinical use
    - Development/evaluation of policies and procedures related to the appropriate clinical use of radiation for nuclear imaging and/or radioactivity measurement purposes
    - Review of radiopharmaceutical dosimetry information noted in patient records
    - Development and management of a comprehensive quality management program that monitors and evaluates critical nuclear imaging and radioactivity measurement equipment and processes
    - Development/evaluation of a comprehensive clinical radiation safety program in nuclear medicine
    - Consultation on patient or personnel radiation dose and associated risks
- **Reappointment:** Reappointment should be based on unbiased, objective results of care according to the organization’s existing quality assurance mechanisms.

Applicants must be able to demonstrate that they have maintained competence by showing evidence that they have performed annually over the reappointment cycle at least 50 procedures in the field of medical physics in which they are seeking privileges.

In addition, continuing education related to medical physics should be required.

I understand that by making this request I am bound by the applicable bylaws or policies of the hospital, and hereby stipulate that I meet the minimum threshold criteria for this request.

Applicant’s signature: ________________________________________________________________

Typed or printed name: _______________________________________________________________

Date: ____________________________________________________________________________
The information contained in this document is general. It has been designed and is intended for use by hospitals and their credentials committees in developing their own local approaches and policies for various credentialing issues. This information, including the materials, opinions, and draft criteria set forth herein, should not be adopted for use without careful consideration, discussion, additional research by physicians and counsel in local settings, and adaptation to local needs. The Credentialing Resource Center does not provide legal or clinical advice; for such advice, the counsel of competent individuals in these fields must be obtained.

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