Roles and Responsibilities of Medical Physicists and Health Physicists in Radiation Therapy

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Public Concern About Radiation

Articles in Philadelphia Inquirer about prostate treatments at the VA Hospital.

Series in the New York Times on doses due to improper use of CT Scans, and error in planning for radiation oncology treatments.

Errors blamed on increasing complexity of linear accelerators, inadequate training, complexity of treatments, including IMRT and IGRT.

Need for supervised Quality Management Programs [QMP] and increased vigilance in quality assurance.

ACCREDITATIONS

Joint Commission on Accreditation of Health Care Organizations [JCAHO]

American College of Radiology [ACR] – site visits, 3-year cycle

American College of Radiation Oncology [ACRO]– site visits, 3 year cycle.

American Society for Radiation Oncology-
left the ACR program to establish a separate accreditation program.

CMS – require accreditation to reimburse services.

CARE (Consistency, Accuracy, Responsibility and Excellence in Medical Imaging and Radiation Therapy)

CARE Bill has been supported by major radiological organizations [RSNA, ACR] for a number of years, but has not made it to the congressional floor.

Care Bill

- Would require individuals who render technical care in imaging or radiation oncology to be certified – certification body unnamed.
- Satisfy the criteria established by the states for the technical specialty.
- Certification versus licensure: Medical physics is a licensed profession in 4 states [NY,TX, FL and HI]. In NYS, there is a subspecialty in medical health physics.
- Defining the scope of practice.

COMPLEXITY OF THE FACILITY

LEVEL I

One or two accelerators in a “stand alone” facility with or without a hospital affiliation. [Private practice setting]

May have consultants who perform all services, full-time, part time. May have one or two full-time medical physicists.

Typically all radiation safety services are rendered by the medical physicist on-site or are included in a consultant contract. The consultant may also serve as the RSO. Alternately, an authorized user [AU] may also serve as the RSO. The consultant may have a CHP who renders some of their services.

There is no radiation safety committee [RSC].

COMPLEXITY OF THE FACILITY

LEVEL II

More than two linacs, equipped with multi-leaf collimation, cone beam CT. Most likely facility has hospital affiliation. May or may not have HDR units. The HDR units will likely be housed within a linac treatment room. Special techniques may include SBRT, SRS.

Most likely full-time, on site medical physicists and dosimetrists who participate in the quality control and quality management programs [QMP]. Medical physicists and dosimetrists prepare treatment plans, including IMRT, IGRT, 4-D planning.

Health physicist(s) manage personnel monitoring and participate in the QA and QMP programs. MP or HP is designated as the RSO and there may or may not be a RSC, depending on the program for sealed and unsealed sources.

COMPLEXITY OF THE FACILITY

LEVEL III

Facility has multiple accelerators all equipped with multi-leaf collimation and cone beam CT. Facility has hospital affiliation. There may be multiple regional sites. There are both HDR and LDR programs. There may be a stand-alone HDR treatment suite. Special techniques such as SRS, SBRT and hypofractionation are used.

There are full-time, on site medical physicists and dosimetrists who participate in the quality control and quality management programs [QMP]. Medical physicists and dosimetrists prepare treatment plans, including IMRT, IGRT and HDR planning.

Health physicist(s) manage personnel monitoring and participate in the QA and QMP programs. HP is designated as the RSO and there is a RSC. Health physicist supervises the sealed source inventory and management programs. Radiation surveys are provided by the HP.

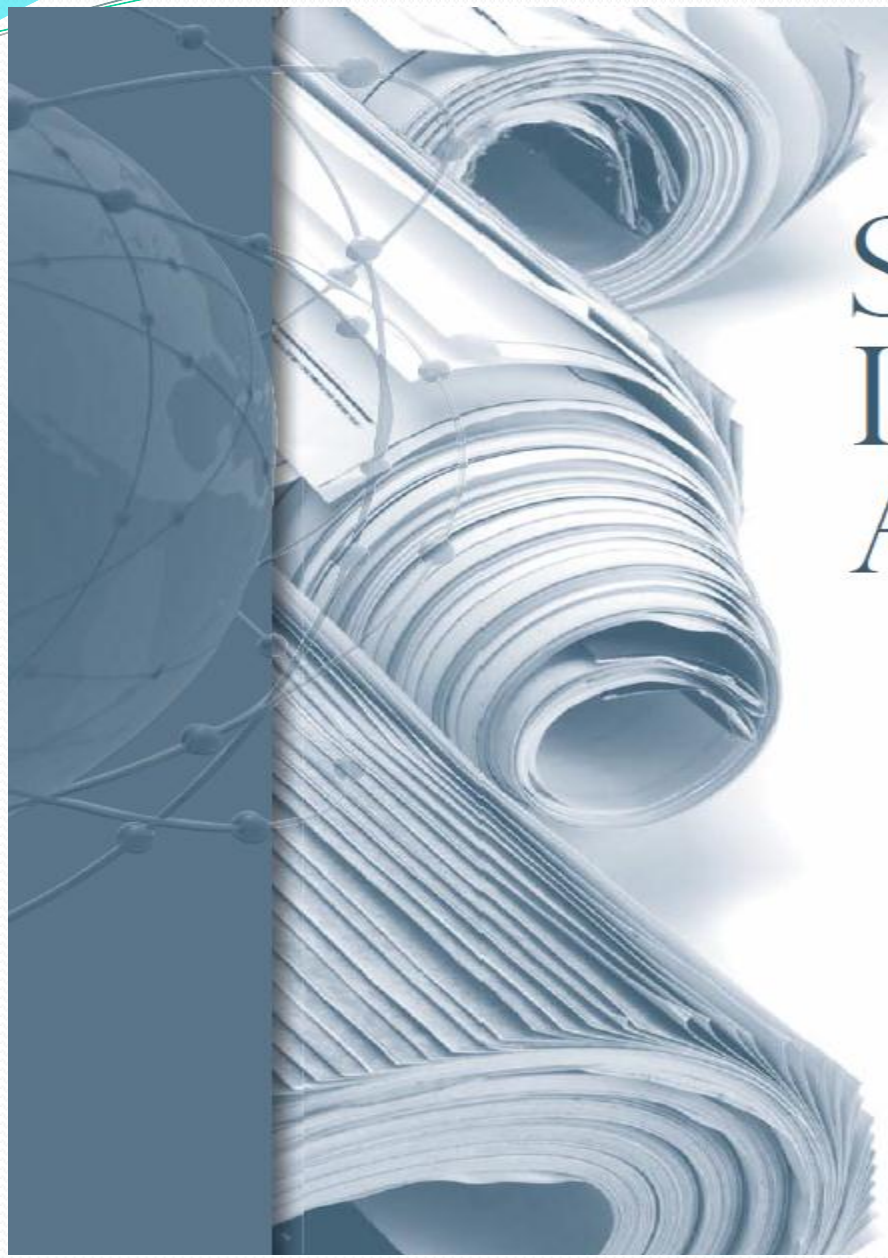
LINEAR ACCELERATORS

Design of structural shielding

NCRP Reports 147 and 151

All accompanied by CT for simulation; PET/CT and in future, MRI-Sims.

- perform actual calculations
- review of shielding specifications provided by consultant or on-site staff
- review and oversight of construction
- survey of completed installation
- license or registration of the installation



SAFETY IS NO ACCIDENT

A FRAMEWORK FOR QUALITY RADIATION ONCOLOGY AND CARE

DEVELOPED AND ENDORSED BY:

American Association of Medical Dosimetrists (AAMD)
American Association of Physicists in Medicine (AAPM)
American Board of Radiology (ABR)
American Brachytherapy Society (ABS)
American College of Radiology (ACR)
American College of Radiation Oncology (ACRO)
American Radium Society (ARS)
American Society for Radiation Oncology (ASTRO)
American Society of Radiologic Technologists (ASRT)
Association of Freestanding Radiation Oncology Centers (AFROC)
Society of Chairmen of Academic Radiation Oncology Programs (SCAROP)

Table 2.2. Certification and Licensure Requirements

Profession	Relevant Certifying Body	State Licensure Required?	Information Resources
Radiation Oncologist	ABR	Yes	www.theabr.org
Medical Physicist	ABR ABMP CCPM	In 3 states as of 2011(FL, NY, TX)	www.theabr.org www.abmpexam.com www.ccpm.ca
Medical Dosimetrist	MDCB	No	www.mdcb.org
Radiation Therapist	ARRT ASRT	Yes (Currently in 35 states)	www.arrt.org www.asrt.org
Nurse Practitioner	AANP ANCC	Yes Yes	www.aanp.org www.ancc.org
Oncology Nurse	ANCC ONCC	Yes	www.www.nursecredentialing.org www.oncc.org
Clinical Nurse Specialists	ANCC	Yes	www.ancc.org
Physician Assistant	NCCPA	Yes	www.nccpa.net

In the radiation oncology clinic, these professionals are ultimately responsible for creating a culture of safety. Society has entrusted physicians and medical physicists as the guardians of both the individual and societal health care structure. With this trust, they are empowered to operate as advocates for safety-related initiatives. Leadership needs to make all staff feel comfortable to raise concerns about safety without fear of reprimand or reprisal.

Table 3.2. Examples of Peer Review and Quality Assurance Items *

	Peer Review	Quality Assurance
Physician	• Target definition	• Verify appropriate nomenclature and documentation • Verify dose constraints are within policy • Review portal films
Medical Physicist	• Verify machine output	• Verify the correct transfer of data from the planning system to the treatment machine
Medical Dosimetrist	• Assess selection of beam orientation and weighting • Evaluate plan for target coverage and normal tissue exposure	• Verify that prescription matches the treatment plan
Radiation Therapist**	• Double check patient setup accuracy	• Ensure patient-specific procedure time-out

* Examples shown are items that might be (somewhat arbitrarily) divided into the peer review and quality assurance.

** In addition, two radiation therapists should always be available in the event of emergencies and as a "second set of eyes" to verify information during time-outs for procedures.[12]

AUDITS

External Audits – typically ACR or ACRO audit is accepted as an external audit.

Internal Audits – typically required annually. Requires review by both the health physicist and medical physicist. Includes chart review and review of practice.

3.4.13 Quality Assurance Committee

A dedicated formal QA committee should consist of a multidisciplinary team (e.g., physicians, medical physicists, medical dosimetrists, nurses, radiation therapists and IT support) that meets regularly and serves as liaison with leadership and hospital-wide safety committees. This committee should develop initiatives related to patient safety (e.g., sections 4.1-4.12), which are feasible and work best for the individual institution. This committee should ensure that a mechanism for reporting and monitoring errors and near-misses is in place, that leadership is aware of trends, and that a process exists for implementing change when needed. Monitoring appropriate compliance with local, national and international safety, licensure and credentialing standards falls under this committee, as does developing mechanisms to investigate serious or potentially serious incidents in near real-time (e.g., less than 24 hours). Such mechanisms may include having a dedicated team on-call to meet with staff involved in an error or near-miss, to help in determining root causes of the incident, to provide input on the potential impact of the error or near-miss and on proposed solutions or recommended changes (if any). This committee also disseminates safety information through peer review meetings, the morning meeting and safety rounds, in addition to more formal safety, QA or possibly morbidity/mortality rounds.

4.1.4 Monitoring Safety, Errors and Medical Quality

One of the most crucial activities in a quality radiation oncology department is the organized review and monitoring of all aspects of safety, errors and quality. Creating a "culture of safety" depends on guidance, direction and financial means from the leadership of the institution and of the radiation therapy department; on individual effort by every member of the department; and on organized support for quality and safety at every level in the institution. This section briefly describes a few of the organization- and department-level activities that can help to create the necessary culture and awareness.

4.1.4.1 Quality and Error Monitoring

Each department should have a department-wide review committee which monitors quality problems, near-misses and errors in treatment, diagnosis, patient care or other procedural problems that might lead to errors. This committee should organize the collection and analysis of such events, work to identify potential problems in devices or processes, and then try to mitigate these problems by modifying processes or adding new checks or actions to minimize the likelihood of further problems. It is important that these kinds of safety-related efforts, data and notes be identified as peer review protected and not subject to legal discovery. Further detail can be found in Chapter 3, Safety.

Brachytherapy

Use of sealed sources for intracavitary applications or for interstitial placement. Such uses may be temporary or permanent.

Table 4.3. Brachytherapy Devices

Brachytherapy sources or devices
Radiation sources General HDR and pulsed-dose-rate remote (PDR) afterloaders LDR sources ^{90}Y unsealed sources Electronic brachytherapy sources Liquid radioactive sources (Iotrex) Intravascular brachytherapy (IVBT) sources
Applicators
Hardware
Imaging devices
Treatment planning systems and dose calculation processes
Survey instruments, badges, radiation safety

4.2.3.1 Qualification of Brachytherapy Personnel

To administer brachytherapy, a qualified physician and medical physicist must be present for the initiation of treatment. Board certification or eligibility is required by the radiation oncologist and the medical physicist with other staff requiring registration for all cases. A specific "Focused Practice" certification in brachytherapy through the ABR is now available for brachytherapy practice, signaling the specialty's recognition of the increased complexity of many procedures and the need for enhanced expertise for all but the most routine brachytherapy cases.

Subject	Checks Performed By	Tasks	Most Efficient Timing
Overall treatment strategy	Radiation Oncologist Peer Review, Multidisciplinary Physician Conference/ Clinic	Review of patient case, clinical issues, possible treatment strategies, overall patient treatment strategy to be pursued; peer review of general treatment strategy	Before planning process
Planning directive	Radiation Oncologist, Medical Dosimetrist, Medical Physicist	Describe plan intent, target volumes, dose expectations, normal tissue limits, other treatment constraints or goals; peer review of goals and limits is important.	Before planning process
Approval of volumes	Radiation Oncologist, Medical Dosimetrist, Medical Physicist	Verify accuracy and appropriateness of target volumes (including GTVs, CTVs, PTVs, ITVs (per ICRU-50 [52], ICRU-62 [53], and ICRU-70 [54]) and critical normal tissues; peer review of target volumes and decisions is important.	Initial step of planning process
Treatment prescription accuracy	Radiation Oncologist, Medical Dosimetrist, Medical Physicist	Define dose fractionation techniques and dosimetric constraints	Before final plan checks
Treatment plan quality	Medical Dosimetrist, Medical Physicist	Verify beam designs, dose calculation parameters and reasonability of dosimetric results; check evaluation metrics for correctness and compare to plan directive; peer review of plan adequacy, quality and complexity is important.	Before final physics and physician review, before plan preparation for treatment
Treatment plan approval	Radiation Oncologist	Approval of treatment plan	Before final checks and clinical use
MU calculation	Medical Physicist	Verify accuracy and appropriateness of MU calculation.	After plan approval; before plan download to

Roles Assigned to the RSO for LDR Brachytherapy

- Ordering and inventory of sealed sources for interstitial use.
- Leak testing of sealed sources.
- Surveys of patients treated with LDR sources, typically either I-125 seeds or Pd-103 seeds.
- Discussions or consultation with patients.
- Instruction of medical staff.

Roles Assigned to the RSO for HDR Brachytherapy

- Surveys after source replacement.
- Initial survey of facility
- Licensing for HDR sources
- Licensing of Authorized Users and Authorized Medical Physicists
- Staff education.

NCRP 155 - Appendix C – QUALITY ASSURANCE FOR HIGH DOSE RATE [HDR] BRACHYTHERAPY APPLICATIONS

C.1	Treatment Preparation Checks
C.2	Applicator Checks
C.3	Implant Localization and Imaging
C.4	Treatment Prescription
C.5	Treatment Planning
C.6	Pre-Treatment Review
C.7	Patient Setup and Treatment
C.8	Setup Accuracy
C.9	Treatment
C.10	Post-Treatment Checks

Medical Events

Definitions in 10 CFR 35 may be modified somewhat by the Agreement States. A number of states do not have yet have regulations that cover medical events with accelerators, only sealed or unsealed sources.

The event(s), reportable or recordable, are to be discussed by the Quality Assurance Committee {QAC}, and any systematic problems identified. These events should also be trended to further identify process problems.

MEDICAL EVENTS, II

Events are to be investigated by the RSO who is regarded as "event neutral". The RSO will rely on the medical physicist to calculate the doses involved to determine if the event meets the reporting criteria.

The RSO may lead the investigation if a Multi-disciplinary Root Cause Analysis [MRCA] is deemed necessary. This may be required by state regulations or the institution itself.