COMP OCPM
Canadian Organization of Medical Physicists
Organisation canadienne des physiciens médicaux

Medical Physics Core Competency Profile

Preamble

Medical Physicists are professionals who work in health care with specialized expertise in the application of physics to medicine. The Canadian Organization of Medical Physicists (COMP) recognizes four specific sub-specialties within the Scope of Practice for Canadian Certified Medical Physicists which result in Membership with the Canadian College of Physicists in Medicine (CCPM): Radiation Oncology Physics, Diagnostic Radiology Physics, Nuclear Medicine Physics, and Magnetic Resonance Imaging Physics. Within these sub-disciplines, Medical Physicists hold an array of responsibilities related to patient care and the complex medical devices that support it. COMP has developed the following Core Competency Profile to identify the core skill set collectively possessed by Medical Physicists working in Canada. While many of the competencies are common to all Qualified Medical Physicists, others are sub-specialty specific. The competencies laid out here, are intended to articulate knowledge and skills that are both teachable and testable. It is also important to note that the competencies are not exclusive to the Medical Physics profession. Medical Physicists play an integral role in multi-disciplinary teams delivering healthcare services to the Canadian public.

Medical Physicists in Canada work in a variety of environments including clinical, academic, regulatory and in industry, as discussed in the COMP Scope of Practice document. While the principles and knowledge discussed in this document can apply to several of these practice environments, this document is specifically aimed at the clinically practicing medical physicist. The competencies outlined herein are those a Medical Physicist would generally possess when beginning clinical practice. At this career stage, the Medical Physicist would have completed an accredited residency, received board certification and hold independent responsibility for their clinical activities (i.e. no other physicist signing off on their work).

It must be noted that these core competencies define a spectrum of skills. Not all new Medical Physicists will necessarily possess all related skills to the same degree. The competency profile is intended to define these competencies for the clinical practice of the profession as a whole.

Further, the profile does not limit Medical Physicists to only the competencies listed. Through their careers, Medical Physicists are expected to engage in continuous learning and professional development. Many Medical Physicists will specialize in their clinical practice as their careers progress. Many will develop advanced expertise in some areas while not clinically engaging in others.

In addition to routine clinical duties, Medical Physicists are often charged with bringing novel technologies and procedures into clinical settings, developing new medical devices, and generally advancing medical research. It is their expertise and technical proficiency in the physical sciences and their overlap with medicine that provides the basis for leading such initiatives effectively and safely. Looking across the full scope of practice for Medical Physicists it is then important to note that the full complement of a Medical Physicist's workload and duties may have components without pre-defined, teachable and testable elements that would define a competency or skill.

The development of this Core Competency Profile is an essential step in professional practice, however. It defines those aspects of the profession associated with teachable, testable technical skills, and defines requirements for meeting basic safety, professionalism, and ethical standards of practice. The standards are meant as safeguards for the protection of the public. They are a foundation upon which to build, and higher levels of proficiency are encouraged.

This profile was developed by the COMP Core Competency Working Group, comprised of Subject Matter Experts (SMEs) under the mandate of the Professional Affairs Committee (PAC).

The profile will be of value to users both within and outside the profession. By specifically articulating the core competencies of the Medical Physics profession in Canada, this document will:

- Establish a set of uniform standards for new Medical Physicists and Medical Physicists from other jurisdictions who will practice clinical Medical Physics in Canada
- Provide employers information on the minimum expectations of entry-level Medical Physicists
- Provide a guide for the curriculum of Medical Physics education programs--including graduate, residency, post-graduate certification programs, as well as professional development and continuing education initiatives
- Guide the growth of residents through their residency programs
- Establish a blueprint for examination standards

Each core competency consists of a listing of enabling competencies, defined as a skill or practice task that can be performed with entry-level proficiency. Entry-level proficiency is characterized as follows:

- Standards exist that define the proficiency.
- The proficiency is both teachable and testable.

- When presented with routine situations, the Medical Physicist performs the relevant competency in a manner consistent with generally accepted standards in the profession, safely, independently, and within a reasonable timeframe.
- The Medical Physicist recognizes unusual, difficult to resolve and complex situations which may be beyond their capacity. The entry-level physicist takes appropriate steps to address these situations, which may include consulting with others, seeking supervision or mentorship, reviewing literature or documentation, or referring the situation to a more experienced Medical Physicist.

The competencies are separated into general categories. Each category is made up of multiple key competencies and these are broken down further into enabling competencies. The profile identifies the common competencies first and diverges into sub-specialty specific competencies in the end.

Competencies

1. Professionalism

1.1. Adherence to legal and regulatory requirements.

1.1.1. Ensure compliance with provincial and federal legislation and requirements. This includes areas of specialization such as regulations governing ionizing and radio-frequency radiation, radioactive sources, and healthcare and safety standards. It also includes workplace and professional standards such as occupational health & safety, harassment in the workplace legislation and broader public sector procurement legislation, among other relevant acts, laws and regulations.

1.1.2. Maintain privacy and confidentiality of all patient health information (PHI) in accordance with relevant legislation.

1.2. Application of ethical principles.

1.2.1. Adhere to and comply with institutional ethics, conflict of interest policies, the COMP Code of Ethics and other policies relating to professional conduct and behaviour endorsed by COMP.

1.2.2. Practice within limits of professional knowledge, expertise, skills and exercise good judgement.

1.2.3. Maintain professional boundaries through respect of the expertise of other health professionals (Physicians, Medical Radiation Technologists, etc.).

1.3. Professional integrity.

1.3.1. Practice within organizational policies and directives.

1.3.2. Respond professionally to changes impacting the work environment.

1.3.3. Use professional judgement and critical thinking skills to reach decisions.

1.3.4. Demonstrate accountability for decisions, actions and outcomes.

1.4. Integration of best practices for personal health and wellness to ensure safe practice.

1.4.1. Continuously learn and employ techniques to manage personal stress in the workplace and promote a healthy work-life balance.

1.5. Utilization of safe work principles and procedures.

1.5.1. Understand and employ effective risk management strategies (e.g. failure modes effects analysis).

1.5.2. Develop, employ, follow and systematically review standardized practices.

1.5.3. Establish and actively contribute to a culture of workplace safety and ensure a safe work environment through appropriate use of protective devices, equipment, and apparel, adapting safety practice according to the hazard.

1.5.4. Assess the integrity of personal protective equipment and devices.

1.5.5. Apply knowledge of radiation effects and risks, monitor personal radiation exposure, and through application of the ALARA principle, adjust practice accordingly.

1.5.6. Recognize and respond to facility emergencies.

2. Communication

2.1. Establish and maintain effective communication.

2.1.1. Establish a rapport and trust with colleagues, other medical professionals (Physicians, Medical Radiation Technologists, etc.), as well as patients and their families.

2.1.2. Use effective written communication skills including professional electronic communication etiquette.

2.1.3. Use effective verbal and non-verbal communications skills.

2.1.4. Use effective interpersonal skills.

2.1.5. Seek and respond professionally to feedback from others.

2.2. Seek out, clarify and disseminate information.

2.2.1. Gather information through systematic research of credible scientific sources.

2.2.2. Analyze and scrutinize information through the application of sound scientific method.

2.2.3. Provide clear and concise explanations for technical issues related to the application of physics to medicine so as to facilitate knowledge transfer to colleagues and other medical professionals, patients and their families, taking into consideration the level of understanding of the recipient.

3. Collaboration

3.1. Work effectively as part of a multi-disciplinary health care team.

3.1.1. Establish and maintain positive relationships with colleagues and other members of the multi-disciplinary health care team.

3.1.2. Understand and respect professional practice boundaries of health care professionals in the multi-disciplinary team.

3.1.3. Engage in sound scientific, fact-based and respectful shared decision making with members of the multi-disciplinary health care team.

3.2. Work to resolve conflict with a collaborative approach.

3.2.1. Use appropriate conflict management techniques to solve differences of opinion in a respectful manner with the goal of a positive outcome for all collaborators.

3.2.2. Remain open-minded to the professional opinions of colleagues, and members of the multi-disciplinary health care team and be willing to compromise towards solutions for the greater good.

3.3. Seek out and maintain healthy internal and external collaborative relationships.

3.3.1. Work with colleagues and other members of the multi-disciplinary team to find new opportunities for collaboration and mutual growth.

3.3.2. Reach out to and work with external groups/facilities/institutions to facilitate collaborative knowledge transfer, sharing of best practices and enhancing the profile of the organization in the community.

3.3.3. Promote others' ideas as their own and give credit where credit is due.

4. Facilitation of Patient Care

4.1. Practice so as to facilitate patient safety.

4.1.1. Track, investigate and facilitate learning from relevant errors, near misses and identified dangerous circumstances that put patients at risk for harm.

4.1.2. Approach the implementation of new technologies, procedures and devices with systematic reviews of risk.

4.1.3. Identify and seek to minimize conditions that present unreasonable risks to patients.

4.2. Practice so as to facilitate high quality of care.

4.2.1. Implement and oversee quality control and management programs for all medical devices and procedures that fall under the care and/or management of the Medical Physicist.

4.2.2. Routinely review and update practices, procedures and standards.

4.2.3. Understand and facilitate minimum standards of care for all patients.

4.2.4. Seek reasonable balance between optimal and sufficient treatments (as optimal as reasonably achievable, social and economic factors considered).

4.2.5. Ensure patient dignity and confidentiality are maintained both during care and when acting as a custodian of patient information.

4.3. Provide education and support to patients, families and other caregivers.

4.3.1. Provide education as needed related to procedures, technologies, evidence-based science, risks and safe practices.

4.3.2. Provide guidance, education and support to frontline caregivers in the application of physical science principles to medicine.

4.3.3. Refer individuals to appropriately qualified experts as necessary.

5. Leadership

5.1. Contribute to the technical advancement of the medical field through the application of physics to medicine.

5.1.1. Provide expert scientific guidance to the organization on the adoption of new technologies to ensure safe and effective clinical implementation.

5.1.2. Participate in the development of new clinical technologies.

5.1.3. Provide input and guidance on the development of clinical trials involving new technologies.

5.2. Act as mentors for students/colleagues/peers.

5.2.1. Provide clinical instruction to trainees in medical physics, radiation oncology, radiation therapy and other related fields.

5.2.2. Foster professional growth in others by providing guidance and constructive feedback.

5.3. Maximize efficiency of clinical processes.

5.3.1. Seek to continuously improve clinical workflow.

5.3.2. Seek to optimize the use of resources.

5.4. Assume a role of leadership in developing international, national and provincial quality assurance and quality control standards.

5.4.1. Identify and implement best-practice quality assurance and quality control programs.

5.4.2. Analyze failures in the quality assurance process, identify weaknesses and solutions to mitigate future risk.

6. Scholarship

6.1. Engage in continuing education and professional development.

6.1.1. Identify gaps in one's knowledge and understanding and develop a personal learning plan to continuously enhance knowledge base.

6.1.2. Identify opportunities for learning and improvement through various relevant internal and external resources.

6.1.3. Maintain professional certification through continuing education opportunities.

6.1.4. Identify gaps in one's interpersonal and professional skills and seek out workshops and/or mentors to further develop these essential skills.

6.2. Engage in teaching students, residents, colleagues, health care professionals and the public.

6.2.1. Promote a safe and respectful learning environment.

6.2.2. Ensure patient safety, dignity and confidentiality are maintained when learners are involved with care.

6.2.3. Plan and deliver effective learning activities.

6.2.4. Provide constructive feedback to promote a positive, supportive learning environment and promote performance.

6.2.5. Assess and evaluate learners, teachers and programs to an appropriate manner to foster innovation and excellence.

6.3. Engage in research activities associated with the advancement of the medical field through the application of physics to medicine.

6.3.1. Demonstrate an understanding of the principles of the scientific method to the investigation of new and novel technologies and their application to medicine.

6.3.2. Support the development and implementation of clinical research trials through application of research principles, ethics and methods.

6.3.3. Summarize and communicate to professional and lay audiences, the findings of relevant research and scholarly inquiry.

Clinical Physics Competencies
Sub-specialty: Radiation Oncology Physics

RO. 1. **Management of Radiation Treatment Delivery and Imaging Systems**

List RO.A.1 identifies the typical radiation treatment delivery and imaging systems common to a modern radiation therapy environment in which Medical Physicists in the Radiation Oncology Physics sub-specialty (ROMPs) are likely to have, or can be expected to develop, professional expertise. ROMPs will have a foundational understanding of the theory operation and underlying physical principles of these systems. They will have experience in operating and managing some model of most of these systems, dependent upon resources available at their individual training programs.

Further, List RO.A.2 identifies common complex ancillary systems used to support radiation treatment delivery and imaging systems. ROMPs will be skilled in, or may be expected to develop skill in, the application of these tools. With respect to patient support devices, while ROMPs do not routinely set up patients for treatment, they may be called to provide expert advice on how such devices maybe employed, or modified, to commission them for use, or to support their management of in the context of treatment delivery and imaging systems.

The following are key competencies for ROMPs with respect to these systems:

RO. 1.1 Provide expert guidance on technical specifications and procurement.

RO. 1.2 Supervise installation and perform acceptance testing to confirm systems are performing according to predefined specifications.

RO. 1.3 Acquire commissioning data to prepare systems for safe clinical use.

RO. 1.4 Calibrate the equipment and/or radioactive sources used for radiation treatment according to internationally accepted best-practice.

RO. 1.5 Provide education and training to colleagues, health care professionals and the public to ensure optimal and safe use of the systems.

RO. 1.6 Establish, revise, supervise, and perform quality control and quality assurance programs in compliance with regulations, accreditation organization(s) standards or accepted best-practices. This includes the capacity to measure, track and analyze relevant performance metrics.

RO. 1.7 Establish and supervise a preventative maintenance program in accordance with regulations, manufacturers' specifications and accepted best-practices. This includes tracking and management of technical bulletins and upgrades.

RO. 1.8 Develop and supervise the processes to authorize the safe return to clinical service of equipment after preventative and corrective maintenance.

RO. 1.9 Recognize and respond to emergencies involving the equipment and associated technologies.

RO. 1.10 Lead, assist, or provide expert direction during incident reviews pertaining to or involving the use of systems and equipment in lists RO.A.1 and RO.A.2.

RO. 1.11 Assess the performance of imaging systems used in the treatment planning and delivery process for image quality and dose optimization, including the process to authorize the safe return to clinical service of imaging equipment after preventative and corrective maintenance.

RO. 1.12 Establish the protocol for and apply best practice to in-vivo dosimetry measurements.

List RO.A.1. Radiation Oncology Systems

1. Class II prescribed equipment as defined in Canada's Nuclear Safety and Control Act, including but not limited to:
   1.1. Linear accelerators that deliver megavoltage photon and electron beams,
   1.2. Small field systems (SRS, dedicated SBRT units with micro MLCs)
   1.3. Teletherapy (Co-60) units
   1.4. Gamma Knife systems
   1.5. Brachytherapy remote afterloaders
   including: low dose rate, pulsed dose rate and high dose rate systems
2. Brachytherapy implants (temporary and permanent) and ancillary systems
3. Orthovoltage or kilovoltage radiotherapy systems
4. CT simulators
5. MR simulators
6. Total body irradiation (TBI) systems
7. Total skin electron therapy (TSET) systems
8. Intraoperative radiation therapy systems
9. Radiotherapy image guidance systems including:
   9.1. Planar MV and kV imaging systems

9.2. Cone beam CT systems
9.3. Non-radiographic localization systems including but not limited to: ultrasound, optical surface monitoring systems, radiofrequency beacon tracking, MR-guided systems, etc.
9.4. Respiratory gating systems

List RO.A.2 Ancillary Radiation Oncology Systems and Equipment

1. Radiation dosimetry systems including, but not limited to:
    1.1. Ion chambers and electrometers
    1.2. Diode dosimeters
    1.3. Thermoluminescent dosimeters (TLDs)
    1.4. Optically stimulated luminescence dosimeters (OSLDs)
    1.5. Radiochromic film and scanners
    1.6. Well chambers
2. Dosimetry scanning systems including, but not limited to:
    2.1. Robotic water tank scanning systems
    2.2. Diode arrays (1D, 2D, 3D)
    2.3. Portal dosimetry systems
3. Common radiotherapy immobilization and patient support systems
4. Brachytherapy applicators
5. Radiation survey equipment including, but not limited to:
    5.1. Ion chamber survey meters
    5.2. Geiger-Muller survey meter/counting systems
    5.3. Neutron detection systems such as boron mediated ion chambers and gel-bubble dosimeters
    5.4. Personal dosimeters (electronic, OSLD, TLD, etc.)
6. Radiological Phantoms including, but not limited to:
    6.1. CBCT phantoms with integrated modules for assessment of image quality,
    6.2. kV and MV image quality phantoms (contrast detail, image uniformity, MTF, etc.)
    6.3. Respiratory motion phantoms
    6.4. Radiological anthropomorphic phantoms

RO. 2. **Radiation Dose Calculation and Treatment Planning**

ROMPs have expertise in the physics of radiation transport in medical contexts, in particular as applied to radiation therapy treatment planning. They understand the core principles behind the software algorithms using in planning radiation therapy treatments including the underlying physics, computational methodology, assumptions and limits of models when applied to clinical scenarios.

Key competencies for ROMPs with respect to radiation dose calculation and treatment planning are the following:

RO. 2.1 Calculate appropriate settings (e.g. monitor units, time, etc.) on a given radiation therapy treatment system that will deliver a desired dose or dose distribution within acceptable tolerances. This includes appropriate application of clinical data sets (tissue phantom ratios, percentage depth dose curves, inverse square law, etc.) and appropriate application of inhomogeneity correction methods.

RO. 2.2 Use appropriate software to calculate detailed delivery data (e.g. control point files) required for complex modulated radiation treatment delivery modalities (e.g. VMAT, IMRT, etc.) This includes a thorough understanding of the algorithms used, including, but not limited to inverse planning optimization methods.

RO. 2.3 Asses the quality of images used to develop a radiation therapy treatment plan including the quality of registrations (rigid and deformable) with images from additional modalities (MRI, PET-CT, etc.)

RO. 2.4 Use artefact reduction and other image modification software and methods as appropriate, and identify contraindications.

RO. 2.5 Apply appropriate methods for the segmentation, expansion and/or delineation of planning target volumes, organs-at-risk, or other volumes of interest or clinical relevance. This includes appropriate application of volume expansion methods and techniques for the management of uncertainties due to set up, motion, etc.).

RO. 2.6 Apply knowledge of human anatomy and physiology, and cancer biology relevant to common oncological sites and other diseases treated with radiation to the development of a treatment plan or in other clinical medical physics problem-solving contexts.

RO. 2.7 Identify common medical devices (e.g. pacemakers) and recommend/implement strategies to modify radiation treatment plans to mitigate device failure or sub-optimal performance.

RO. 2.8 Identify the appropriate use and limitations of common dose calculation algorithms.

RO. 2.9 Provide education and training to colleagues and health care professionals to ensure adequate, optimal and safe use of the treatment planning systems. Inform users of contraindications and limitations.

RO. 2.10 Independently generate clinically viable treatment plans consistent with physician-defined prescription goals and constraints.

RO. 2.11 Perform and oversee quality control on radiation therapy treatment plans, applying accepted best-practices. This includes review of the dosimetric component of a treatment plan for accuracy, review for deliverability, and identification of scenarios where the dose actually delivered to the patient is likely to deviate to a clinically significant degree from the plan and implement an appropriate mitigation where possible.

RO. 2.12 Perform and oversee quality control on radiation therapy treatment planning systems, applying internationally accepted best-practices. This includes tracking and management of technical bulletins and upgrades.

RO. 2.13 Ensure appropriate data is collected and applied in treatment planning algorithms to produce clinically acceptable beam/source models.

RO. 2.14 Use appropriate measurement or independent calculation techniques and tools verify radiation plans will be delivered within acceptable tolerances. This includes, but is not limited to: portal dosimetry fluence verification, measuring dose with a 3D or 3D diode array, radiochromic film measurements in a phantom, etc. The ROMP can compare a measured and predicted data sets using appropriate analysis (e.g. gamma metric).

RO. 3. **Informatics and Medical Device Networks**

ROMPs often play integral roles with respect to information management and technology, in particular as relating to the systems and devices in lists RO.A.1 and RO.A.2, and the common software and algorithms listed in RO.A.3.

The following key competencies apply to ROMPs with respect to informatics and medical devices networks:

RO. 3.1 Track treatment planning workflow including patient data and worker tasks to ensure efficient and timely patient throughput.

RO. 3.2 Ensure safe delivery data transfer and data integrity.

RO. 3.3 Ensure safe and adequate storage of treatment planning and delivery related data including back-up, redundancy, and fail-over/fail-back.

RO. 3.4 Understand common error and failure modes and apply in the context of clinical decision making (e.g. proceed with or halt treatment, remove machine from clinical service, etc.), and in the contexts of technical and clinical problem solving.

RO. 3.5 Understand the network architecture relating to medical devices, equipment and software in lists RO.A.1, RO.A.2, and RO.A.3, and apply that knowledge to solve problems and ensure efficient and secure transfer of information.

RO. 3.6 Understand common standards such as the DICOM standard, and can extract and record relevant information as needed.

RO. 3.7 Apply appropriate analytical and statistical methods to clinical data collection and analysis.

List RO.A.3 Radiation Oncology Data, Information Management and Planning Algorithms

1. Radiation therapy treatment planning systems including, but not limited to:
    1.1. Plan preparation and contouring operations
    1.2. Image registration tools
    1.3. Dose calculation algorithms
    1.4. Inverse planning optimization algorithms
    1.5. Automated processes including contouring and planning
2. Radiation therapy dose calculation methods including, but not limited to:
    2.1. Superposition/convolution algorithms
    2.2. Monte Carlo algorithms
    2.3. Grid-based Boltzmann solving algorithms
    2.4. Manual dose calculations techniques including inhomogeneity corrections
3. Record and Verify Systems
4. Radiation oncology information systems including, but not limited to:
    4.1. Patient management, documentation, and radiation oncology workflow control
    4.2. Treatment preparation and tracking applications
    4.3. Import and export control
    4.4. Treatment and imaging review applications
    4.5. Administrative control

5. International standards for the transfer of clinical and administrative data between software applications used by healthcare providers (i.e. DICOM)
6. Picture archiving and communication (PAC) systems
7. Medical devices networks including, but not limited to:
   7.1. Local architecture
   7.2. Basic administration
8. Quality Control Management Software
9. Basic principles of network and data security

RO. 4. **Radiation Safety**

ROMPs are often called on to serve as radiation safety officers or their deputies, support radiation safety officers, lead or support investigations, supervise licensed activities, and/or provide expert advice, leadership, provide operational support of and/or conduct routine clinical duties pertaining to radiation safety.

With respect to radiation safety, the following are key competencies for ROMPs:

RO. 4.1 Administrate licenses for class II facilities and prescribed equipment granted by the Canadian Nuclear Safety Commission (CNSC).

RO. 4.2 Administrate licenses or certification for radiation emitting devices that fall under provincial jurisdiction.

RO. 4.3 Plan and specify the thickness, material and placement of shielding needed to protect patients, workers, the general public, and the environment from medical radiation in accordance with provincial and federal regulations, accepted best-practice and the ALARA principle.

RO. 4.4 Understand and apply international guidelines, national regulations (i.e. Canada's Nuclear Safety and Control Act and subsequent regulatory framework), and applicable provincial regulations.

RO. 4.5 Consult with architects, contractors and facility representatives to effectively implement radiation shielding.

RO. 4.6 Verify through survey/measurement and documentation that required shielding is properly installed and the shielding design goals are met or exceeded.

RO. 4.7 Establish and supervise a Radiation Safety Program, including development of policies and procedures, education and training programs.

RO. 4.8 Develop and supervise the processes for procurement, shipping and receiving, handling, calibration, use, and disposal of radioactive sources and materials.

RO. 4.9 Recognize and respond to emergencies involving radiation exposure in or related to a medical facility or procedure.

RO. 4.10 Provide accurate technical and scientific expertise in review of incidents relating to radiation safety.

RO. 4.11 Facilitate a program for the dose monitoring of personnel and controlled areas.

RO. 4.12 Oversee compliance with federal and provincial radiation safety regulations.

RO. 4.13 Manage an inventory of radioactive sources and/or materials.

RO. 5. **General ROMP Competencies**

ROMPs are often called on for clinical problem solving. This can include a vast array of scenarios such as conducting a failure modes effects analysis in the implementation of a new program, assisting in the design of a new treatment protocol or the fabrication of patient-specific devices, radiobiological calculation of equivalent dose, etc. ROMPs can be expected to draw on an array of skills and background knowledge to inform such activities, while at the same time recognizing their own limitations and not overstepping professional bounds.

The key general ROMP competencies are:

RO. 5.1 Apply a working knowledge of other imaging systems (including, but not limited to diagnostic CT, PET, SPECT, MRI, mammography, ultrasound, fluoroscopy and combined modalities such as PET-CT) to inform radiation therapy treatment planning, image registration, protocol development and general clinical problem solving as appropriate. ROMPs should possess a global view of medical imaging processes and the inherent uncertainties as they would apply in a radiation oncology context.

RO. 5.2 Apply a working knowledge of radiation physics to offer guidance in unusual treatment circumstances (infrequent situations, situations requiring calculations or measurements beyond typical, extended SSDs, etc.).

RO. 5.3 Apply the principles of radiobiology (e.g. linear quadratic dose response model, biologically equivalent dose, oxygen enhancement, effective dose, etc.) in development of new or modification of existing clinical protocols, as appropriate.

RO. 5.4 Apply a working knowledge of physical laboratory techniques and skills in all measurements and clinical investigations including, but not limited to: experimental uncertainty, error analysis, application of probability distributions, regression, curve fitting, hypothesis testing, etc.)

RO. 5.5 Apply a working knowledge of computer science and coding to the design and implementation of software-based clinical tools (e.g. automation and scripting, image assessment, machine learning, etc.)

RO. 5.6 Apply good data security practices to the access and/or transmission of patient data or other sensitive information