RADIATION ONCOLOGY SPECIALITY TRAINING CURRICULUM

Fellowship in Radiation Oncology (F Rad Onc)

Uganda Cancer Institute

Radiation Oncology Specialty Training Curriculum

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Radiation Oncology Curriculum Working Group

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2 INTRODUCTION

The GLOBOCAN 2020 estimated that there were 19.3 million new cases of cancer and almost 10 million deaths from cancer in 2020 [1]. Cancer is a major global public health burden, resulting in significant morbidity and mortality in all regions globally. In sub-Saharan Africa, there has been an increase in mortality attributed to cancer, thought to be arising from weak health infrastructure, late-stage presentation, limited access to screening programs [1]. The incidence of cancer in Uganda is increasing mainly due to increased life expectancy. There were an estimated 34,000 new cases of cancer and 23,000 deaths attributed to cancer in 2020 [1]. The cases are in part driven by the HIV epidemic with three of the AIDS-defining malignancies among the top 5 most frequent cancers in Uganda, namely; Cervix cancer, Kaposi sarcoma, breast cancer, prostate cancer, and non-Hodgkin lymphoma. The 5-year age-standardized relative survival in Uganda (Kyadondo/Kampala Cancer Registry) is reported to be 12% [1], relatively lower compared to most countries in Africa; but this could be due to lack of an efficient cancer registration system (data is generated from two regional cancer registries). Healthcare in Uganda is faced with several challenges particularly limited human resources for health. In oncology, the human resource gap is worst felt as compared to most other specialties. Radiation oncology has been in existence in Uganda for the last 30 years, but currently there three practicing radiation oncologists. The incidence of most cancers is on the rise in Uganda, and over 50-60% of cancer patients will require radiation therapy as part of their treatment, creating a humongous demand for radiation oncologists in Uganda. The ministry of health and the Uganda Cancer Institute anticipate to expand the current access to radiotherapy services to regional clinics, and hence there will be a dramatic increase in the demand for radiation oncologists in Uganda

Cancer care in Uganda is evolving from a centralized referral system to the establishment of regional satellite cancer centers as a means to improve access, and eventually treatment outcomes. The Uganda Cancer Institute (UCI) was founded in August 1967 as the Lymphoma Treatment Centre with support from the National Cancer Institute (U.S), Makerere University, and Mulago Hospital. The UCI is mandated to, among other things undertake and coordinate the management of cancer and cancer-related diseases in Uganda (UCI Act2016); and registers nearly 6,000 new cases of cancer annually. Research and training form one of the central pillars of the UCI, as described in the UCI Strategic Plan 2015 – 2020 [2]. Currently, the UCI already has three oncology-related fellowship programs namely; adult Haematology and Oncology (Medical), Paediatric, and Gynecological oncology subspecialty training. These fellowships are structured within the East African Oncology Institute, a center of excellence in oncology in East Africa region. Through its structures, faculty from well-established fellowships like adult haematology and oncology, easily contribute towards teaching staff for radiation oncology curriculum. At present, the only radiotherapy service in Uganda is centrally located at the UCI, attending to 2,500 new cases annually. The department has three radiation oncologists, three qualified medical physicists, and five qualified radiation therapy technicians. The need to improve the human resource in radiotherapy could be best addressed through the establishment of a local training program for radiation oncologists.

Radiation Oncology is a branch of clinical medicine concerned with the causes, prevention, and treatment of cancer and certain non-neoplastic diseases utilizing ionizing radiation. A radiation oncologist may also use radiation to treat some benign diseases, including benign tumors. Radiation oncologists work closely with other physicians such as surgical oncologists, interventional radiologists, internal medicine subspecialists, and medical oncologists, as well as medical physicists and technicians as part of the multidisciplinary cancer team. Radiotherapy services at Mulago hospital were established in June 1995 under the leadership of Dr Joseph Mugambe Kigula, after installation, and commissioning of a Chinese GWGP80 Cobalt 60 teletherapy machine, procured with support from the International Atomic Energy Agency [1]. In the last 25 years, the department has undergone transformation to

meet the growing needs of radiation oncology in Uganda. Whereas the UCI has expanded infrastructure and equipment for radiotherapy services, there are insufficient number of trained human resource remains a major challenge. Based on the current data, Uganda has a deficit of 54 Radiotherapy departments and at least 94 radiation oncologists[3]. Therefore, the overall goal of this curriculum is to generate specialist radiation oncologists that will be able to function competently while embracing a multidisciplinary approach to care. The specialist training programme curriculum for radiation oncology has been drafted using well-structured resources, including the IAEA Syllabus endorsed by the American Society of Therapeutic Radiology and Oncology (ASTRO) and the European Society for Therapeutic Radiology and Oncology (ESTRO)[4], the Royal College of Radiology (RCR)- Clinical Oncology Training Curriculum[5], Royal Australian and New Zealand College of Radiologists (RANZCR)[6], the College of Radiation Oncologists of South Africa, the College of Radiation Oncologists of Zambia[7], and the ACGME Program Requirements for Graduate Medical Education in Radiation Oncology[8].

3 RADIATION ONCOLOGY TRAINING PROGRAMME OVERVIEW

3.1 Purpose

To deliver, and sustain a critical mass of highly-trained radiation oncologists with professional and technical capabilities to augment the multidisciplinary approach to cancer care, and thus mitigate death and suffering caused by cancer in Uganda and beyond.

3.2 Vision

To become an East Africa regional training center of excellence in Radiation Oncology

3.3 Mission

To equip trainees with skills and knowledge to practice radiation oncology competently and independently while embracing a multidisciplinary approach to cancer care.

3.4 Values

- Professionalism
- Excellence and Innovativeness
- Respect and Equity
- Integrity and Accountability
- Scientific evidence
- Empathy

3.5 Target Group / Eligibility requirements

The training program is open to applicants, Ugandans, and non-Ugandan, who fulfil the eligibility requirements, and the maximum intake will be four students per year, with at least three Ugandans and one non-Ugandan, to a maximum of 16 candidates at any time during their training. The minimum admission requirements into the Radiation Oncology training program will be;

- Bachelor's degree in medicine (MBChB.) or its equivalent.
- Registration by the Uganda Medical and Dental Practitioner's Council
- At least 12 months of direct patient care in internal medicine or paediatrics, or surgery, or gynaecology; or proof of specialist training in the above fields of medicine such as Masters of Medicine in any of the clinical disciplines.

3.6 Program Objective

The objective of the fellowship program is to educate and train physicians to skilfully and competently practice radiation oncology

The objectives of this program are to;

1. Substantially increase the number of trained radiation oncologists to meet radiotherapy service needs for Uganda and East African countries
2. Significantly improve the multidisciplinary approach to cancer care in the region through increasing the number of trained clinical radiation oncologists
3. Increase clinical and radiation oncology-related research output within the East Africa region. The Fellows will be equipped with the knowledge and skills required in handling the rapidly changing role of radiation medicine to provide better health care through the control, early diagnosis, treatment, and palliative care of cancer patients.
4. Significantly contribute towards clinical care and coordinating cancer prevention, control, screening, early detection, rehabilitation, palliative, and terminal care programs in Uganda and the East African region

3.7 Learning outcomes

By the end of the training, the specialist will be able:

1. Demonstrate knowledge and practical skills for the safe, efficient, ethical, and professional practice of radiation oncology to international standard
2. Manifest the ability to provide patient care that is compassionate, appropriate, and effective as regards cancer management including palliative care.
3. Exhibit a sound knowledge of epidemiology, clinical manifestations, pathology, diagnostic algorithm, staging, and standard treatment paradigm of common cancer in Uganda, and Africa.
4. Show the ability to communicate with the patients, other members of the healthcare team particularly in justification of the use of radiotherapy for patient care in a multidisciplinary team.
5. Demonstrate medical expertise in the application of the different techniques of radiotherapy, the concepts leading to improved treatment efficacy and the anticipation/management of adverse effects associated with radiotherapy
6. To acquaint self with the management of cancer in multidisciplinary teams including understanding the role of surgery, chemotherapy, immunotherapy, and targeted therapy in optimal patient care.
7. To demonstrate the ability to opt, ration, and interpret diagnostic laboratory and imaging studies and utilize this information in patient care
8. To apply research skills and disseminate information for the advancement of radiation oncology and medicine.
9. To impart knowledge, practical skills, and clinical experience in the non-surgical / surgical treatment of cancer

3.8 Title of the training award

The title of the award shall be called "**Fellowship in Radiation Oncology**" of the Uganda Cancer Institute, and will be abbreviated as "**F Rad Onc**".

3.9 Scope

The radiation oncology curriculum at the UCI includes 48 months of education in radiation oncology, with a minimum of 36 months in clinical radiation oncology. The training is divided into two parts;

3.9.1 Part I: Basic Sciences

Basic sciences will be undertaken for the first 18 months of the training program. This Part will focus on an introduction to radiation oncology, and will include six (6) block, each three (3) months involving a major clinical rotation for two (2) months and a minor clinical rotation for one (1) month.

Part I : Year 1			Didactic Hours	Practical Hours	Credit Units
1st Block	Gastrointestinal Oncology I	2 months	0	90	0 + 2
	Diagnostic Radiology and Nuclear Medicine	1 month	15	90	1 + 2
	Gynaecology Oncology	2 months	0	90	0 + 2

2nd Block	Anatomical Pathology -	1 month	45	0	3 + 0
3rd Block	Head and Neck Oncology	2 months	0	90	0 + 3
	Cancer Biology and Radiobiology	1 month	60	0	4 + 0
4th Block	Breast Oncology	2 months	0	90	0 + 2
	Medical Physics and Treatment Planning I	1 month	30	90	2 + 2

Part I : Year 2			Didactic Hours	Practical Hours	Credit Units
5th Block	Medical Oncology	2 months	30	90	2 + 2
	Haematology Oncology	1 month	15	90	1 + 2
6th Block	Thoracic Oncology /and Palliative Medicine	2 months	30	135	2 + 3
	Research Project I	1 month	15	90	1 + 2

* 1 Credit equals 15 didactic hours (1 hr./week for 15 weeks) or 45 practical hours (3 h/week for 15 weeks)

During Part I of training, fellows will be evaluated on *assessment and reporting of basic principles (patient factors, tumor factors, and treatment factors) in a patient presenting with cancer.*

- Gain expertise in obtaining a focused history and performing a reliable examination. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of all cancer sub-sites listed in the core clinical problem list.
- Be able to outline treatment options and make a treatment recommendation; describe the role, rationale, benefits, and side effects of radiation therapy; and obtain informed consent.
- Recognize situations with a need for urgent or emergent medical care, including life- threatening conditions.
- Design blocks, contour target(s), and contour normal tissue with minimal inaccuracies; state appropriate dose planning objectives for normal tissues and target(s) of all cancer sub-sites listed in the core clinical problem list.
- Work with radiotherapy planning and treatment delivery staff for palliative, adjuvant, and radical radiation treatment of all cancer sub-sites listed in the core clinical problem list.

3.9.2 Part II: Clinical Oncology

Part 2 will include consolidation of rotations with high relevance to the daily practice of radiation oncology. There ten (10) blocks each three (3) months posting with a consultant in a specific clinical rotation as shown below.

Part II : Year 2			Didactic Hours	Practical Hours	Credit Units
7th Block	Skin and Soft Tissue Oncology	3 months	45	135	3 + 3
8th Block	Paediatric Oncology	3 months	45	135	3 + 3

Part II : Year 3			Didactic Hours	Practical Hours	Credit Units
9th Block	Head and Neck Oncology	3 months	45	135	3 + 3
10th Block	Breast Oncology	3 months	45	135	3 + 3
11th Block	Neuro-Oncology	3 months	45	135	3 + 3
12th Block	Thoracic Oncology	3 months	45	135	3 + 3

Part II : Year 4			Didactic Hours	Practical Hours	Credit Units
13th Block	Research Project II / Treatment Planning II	3 months	45	135	3 + 3
14th Block	Gastrointestinal Oncology	3 months	45	135	3 + 3
15th Block	Gynaecology Oncology	3 months	45	135	3 + 3
16th Block	Radiation Oncology Electives	3 months	45	135	3 + 3

* 1 Credit equals 15 didactic hours (1 hr./week for 15 weeks) or 45 practical hours (3 h/week for 15 weeks)

During Part II of the training program, fellows will be evaluated on *interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*
Build on the knowledge and skills acquired as a junior fellow (Part I).

- Be able to outline treatment options and make a treatment recommendation; describe the role, rationale, benefits, and side effects of radiation therapy and obtain informed consent for complex cases and re-irradiation cases.
- Design blocks, contour target(s), and contour normal tissues accurately; critically evaluate treatment plan options for complex cases and re-irradiation cases.
- Work with radiotherapy planning and treatment delivery staff on complex cases and re- irradiation cases.
- Be able to manage acute and late effects of radiation.
- Have detailed knowledge of literature relevant to all cancer sub-sites listed in the core clinical problem list.

3.10 Partnerships and collaborations

The implementation of this training curriculum will thrive on multi-institutional partnerships to draw experiences, expertise and financial resources to support trainees in this fellowship program. These partners/collaborators will include;

1. Makerere University, College of Health Sciences
    a. Department of Radiology and Radiotherapy
    b. Department of Anatomy
    c. Department of Physiology

    d. Department of Nuclear Medicine
    e. School of Public Health
2. Mulago National specialised Hospital
3. University of Washington
4. Fred Hutch Cancer Research Centre
5. The Christie School of Oncology

3.11 Quality assurance

Steps are being undertaken to establish the Ugandan Society for Clinical and Radiation Oncologists (USCRO) as an independent professional association for radiation oncologists practicing in Uganda, and will contribute towards quality assurance programs of this training fellowship. USCRO will nominate a committee to oversee the program for academic training for radiation oncologists.

The duties of this panel will be as follows;

- Supervise recruitment and induction of trainees into radiation oncology speciality
- Oversee quality of training programme
- Ensure successful curriculum implementation
- Coordinate summative assessment of trainees
- Promote access to relevant education meetings

3.12 Length of Training Programme

The length of the training program in radiation oncology must be 48 months.

3.13 Assumptions

The following assumptions apply for the successful establishment of this training program;

- The Uganda Cancer Institute, with support from collaborators and the Government of Uganda, will provide start-up financial resources for the execution of training activities
- The program will continually attract trainees from all over Uganda, and its neighboring countries in East Africa
- Trainees will contribute to the welfare of training staff through tuition payments
- The training program will attract external support through training grants and scholarships to students

3.14 Dependencies

Successful training will be dependent on the availability of the following;

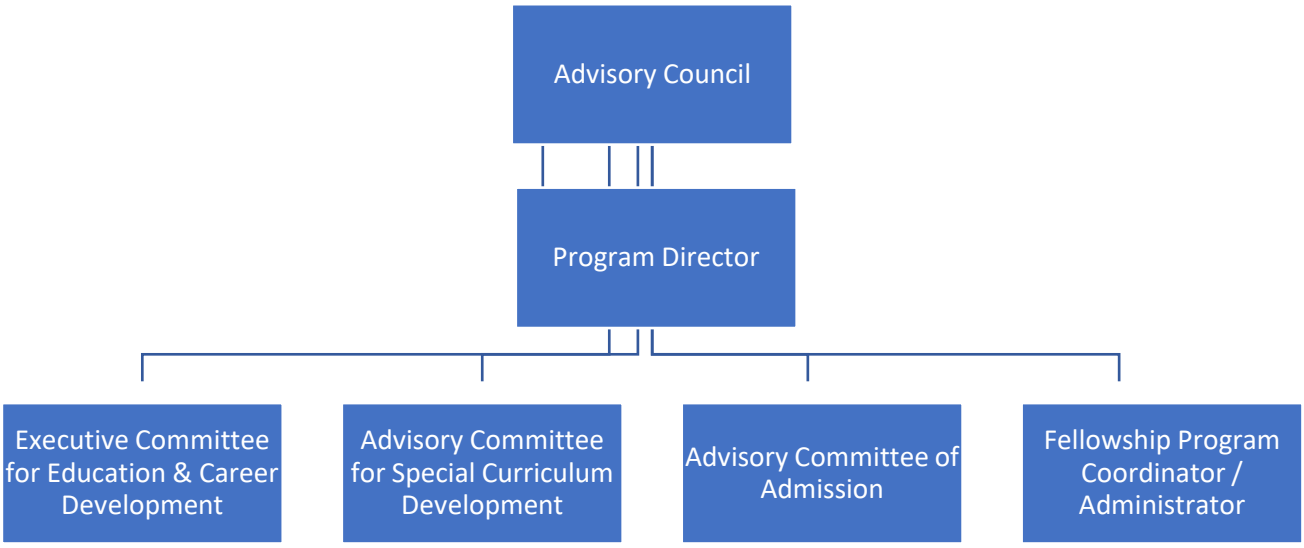
- Access to training facilities within the Uganda Cancer Institute including a library, Fellow's room, clinics, and treatment area
- Commitment from consultants to engage students academically and provide mentorship and supervision
- Availability of regular financial resources towards the training program to meet basic routine expenditures

3.15 Program oversight

The organization and delivery of the training program curriculum will be under the Uganda Cancer Institute – Training division, in collaboration with Makerere University College of Health Sciences and

its affiliated clinical facilities at Mulago National Referral Hospital. The responsibilities and terms of the collaborations are detailed in a separate memorandum of agreement.

The administrative structure of the training program will constitute of the Advisory Council, Program Director, three advisory committees for Education and career development, special curriculum development, admissions; and the coordinator / Administrator (Figure below)



3.15.1 The Programme Director

The programme director(PD) will assume full responsibility and accountability for the training program including compliance with requirements. He or she must be highly qualified (a graduated radiation oncologist) with considerable experience in Fellow education and organizational skills. The PD is responsible for the general administration of the programme, the structure, and its contents. The PD will ensure that the programme fulfils the criteria set in the syllabus and those of the Uganda Medical and Dental Practitioners' Council, and the Uganda Council for Higher Education. The duties of the programme director will include;

1) Organize and conduct a start-up meeting for all lecturers at the start of each academic year. This meeting will be used to communicate the departmental expectations concerning syllabi, assessments, and other teaching practices so that consistency with department goals and values for the course is maintained.
2) Handle administrative tasks associated with hospital practical work experience for students e.g., negotiate appropriateness/schedule hospital visits and time, contact the tutors, handle follow-up paperwork, etc.
3) Allocation of topics to different lecturers, instructors, and consultants
4) Drafting timetables to be followed by lecturers and students as per clinical work in the department
5) Facilitate professional development for the lectures. At least once a semester organizes activities to promote educational reflection; growth and communication among lecturers e.g., academic year day to showcase research activities within the department.
6) Build and maintain a library of activities that people who have been teaching the course have found success in developing and enriching the course content.
7) Recommend placement of students in the relevant sections of i.e., Radiotherapy, Radiology, Nuclear Medicine, medical oncology, etc.

8) Responsible for preparing or facilitate preparing of new materials, such as suggested homework, activities, syllabi, etc. to ensure consistency in the course.
9) Approval of student research topics
10) Coordinate tasks associated with final exam and follow-up of results. These tasks include scheduling rooms, creating the final grading, etc.

3.15.2 Advisory Council

The advisory council is the supreme decision-making body of the training program on matters of education. The council leadership will consist of individuals with the highest level of expertise and achievement in the fields of radiation oncology on issues of graduate medical education, and clinical operations, and health policy and resource management.

4 TRAINING NEEDS ASSESSMENT

4.1 Needs assessment

Worldwide, nearly two-thirds of all cancer patients will require radiation therapy as part of their treatment during the course of their illness, and in developing countries, the proportion in need of radiotherapy for palliation of disease symptoms could exceed 80% since most patients have late-stage at presentation. In Uganda, it is estimated that there are 60,000 new cases of cancer annually, and of these, about 5-10% of patients (6,000 new cases) are diagnosed and registered at the Uganda Cancer Institute (UCI). The UCI Department of radiotherapy is currently the only radiotherapy center in Uganda and attends to at least 2,000 new cases of cancer patients referred for radiotherapy for either curative or palliative purposes. The department has three radiation oncologists, three trained medical physicists, and 5 trained radiotherapy technicians. Therefore, the establishment of a local training program will increase the number of available specialists to meet the increasing demand for radiation oncology in Uganda

The Government of Uganda through the Ministry of Health has demonstrated political will towards increasing the infrastructure for effective cancer management through unwavering support towards the construction of six bunkers and the installation of the first-of-the-kind true beam linear accelerator in East Africa, at the Uganda Cancer Institute. There are also ongoing processes to procure more equipment including nuclear medicine diagnostic equipment such as single-photon emission computer tomography (SPECT) and positron emission tomography (PET/CT). These modern technologies drive the impetus for modern radiotherapy. There is thus a great need to train at a postgraduate level a caliber of the practitioner who by training and practice can effectively grasp and utilize the most recent advances in radiation oncology like linear accelerators, proton and neutron therapy, intensity-modulated radiation therapy (IMRT), and image-guided radiotherapy (IGRT).

The field of radiation oncology is undergoing rapid growth in Uganda with the increasing availability of equipment. At the UCI, additional bunkers have been constructed to accommodate more teletherapy and brachytherapy units. In addition, the regional satellite cancer clinics are anticipated to establish radiotherapy departments as a means to improve access to care in Uganda. Also, we are seeing an increase in the number of private hospitals that have intentions to establish radiotherapy units, and these include St Francis Hospital, Nsambya (Nsambya Hospital), and Mbuya Military hospital. This illustrates that the demand for radiotherapy services in Uganda has significantly increased within the last 2 decades, and this calls for a huge demand for radiation oncologists, medical physicists, therapy technicians, and oncology nurses.

4.2 Justification

The Uganda Cancer Institute is rapidly expanding to establish regional satellite clinics in Uganda, and the need for radiotherapy as a component of comprehensive cancer care is huge and palpable. Therefore, this local training program will not only build capacity to close the human resource gap in the region but also contribute to manpower to operationalize radiotherapy departments in these regional satellite cancer centers. The radiation oncologist will continue to be greatly needed by Uganda, not only to man the national referral hospitals but also eventually the regional and district hospitals as the field of radiation oncology expands to cover the whole country. Human resource development must precede the acquisition of high technology equipment if its use is going to be safe and sustained (www.iaea.org/traininhe need for g).

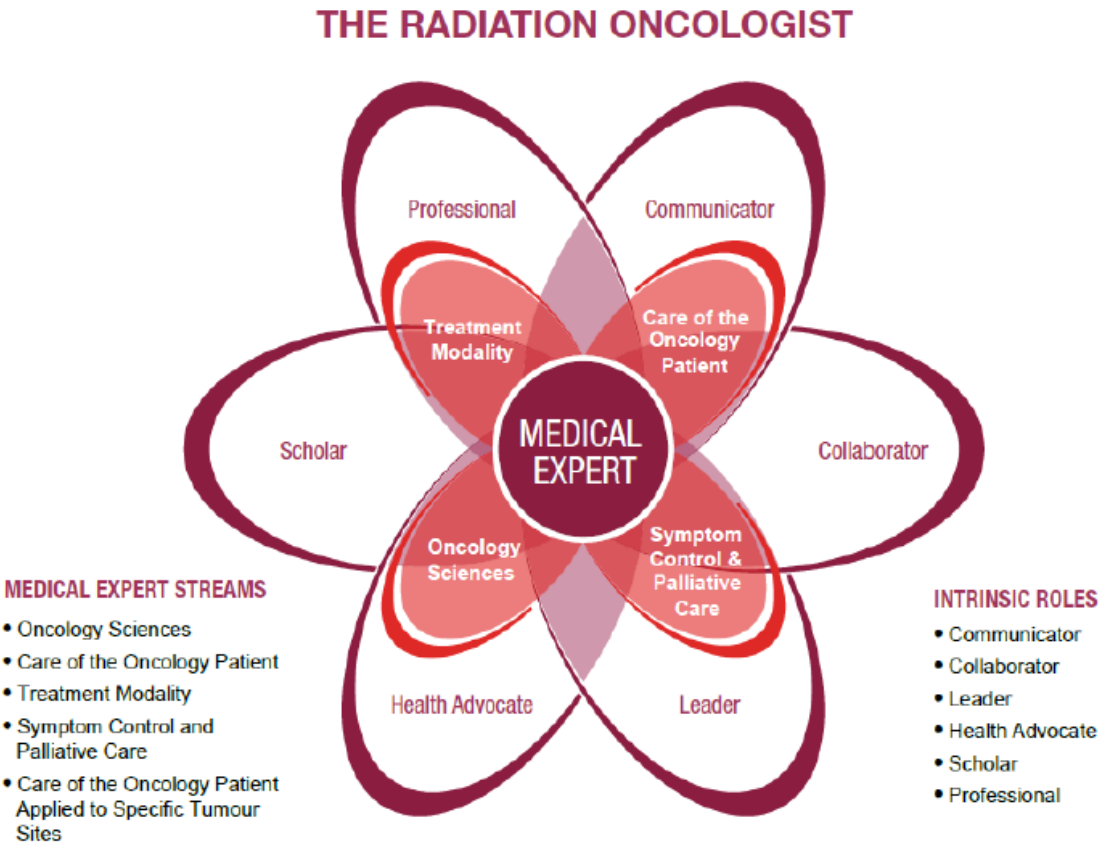
Local training programs for radiation oncologists is the only sure way of self-reliance and capacity building in this broad specialized field with a high chance of retaining these specialists in the country. The training program is anticipated to increase research capacity at the Uganda Cancer Institute

and in Africa, particularly in the field of clinical oncology. Both the trainees and the faculty are expected to actively engage in research activities throughout their clinical practice.

The cost of training radiation oncologists abroad (estimated at over USD 50,000.00 per year) is more than 10 times the local costs and there will always be a risk of brain drain. There is an urgent need to start local training in radiation oncology. This can be done in collaboration with other centers in the East African region, as no such training exists in the sub-region.

4.3 Radiation Oncology competences

The Royal College of Physicians and Surgeons of Canada described the seven roles of a doctor as: Medical Expert, Communicator, Collaborator, Manager, Health Advocate, Scholar and Professional. These were named the Canadian Medical Education Directives for Specialists (CanMEDS) as shown (Figure 1).



At the completion of training, the fellow will have acquired the following competencies and will function effectively as a:

Medical Expert

Definition

As medical experts, radiation oncologists integrate all of the CanMEDS Roles, applying medical knowledge, clinical skills, and professional attitudes in their provision of patient-centered care. Medical Expert is the central role of the physician in the CanMEDS framework.

Key and enabling competencies: radiation oncologists are able to…

1. Function effectively as consultants, integrating all of the CanMEDS roles to provide optimal, ethical, and patient-centred medical care
    - Perform a consultation effectively, including the presentation of well-documented assessments and recommendations in written and/or verbal form in response to a request from another healthcare professional
    - Give an expert opinion about the use of ionizing radiation in the treatment of the patient, including the manner in which this should be integrated with other modalities of treatment
    - Identify and appropriately respond to relevant ethical issues arising in patient care
    - Demonstrate the ability to prioritize professional duties effectively when faced with multiple patients and problems
    - Demonstrate empathetic and patient-centred care
    - Recognize and respond to the ethical dimensions in medical decision-making
    - Demonstrate medical expertise in situations other than patient care, including but not limited to providing expert legal testimony or advising governments, as needed

2. Establish and maintain clinical knowledge, skills, and attitudes appropriate to radiation oncology
    - Apply knowledge of the clinical, socio-behavioural, and fundamental biomedical sciences relevant to radiation oncology. These include but are not limited to the following:
    - Natural history of the full range of malignant diseases, including the aetiology, pathology and molecular aspects of such diseases and preventive measures
    - Natural history and pathology of those benign conditions which may be treated by radiation
    - Anatomy of normal and tumour tissue, including its demonstration by diagnostic imaging
    - Radiation physics
    - Radiobiology
    - Histopathological features associated with radiation's effect on normal tissues
    - Principles of radiation protection and how these are applied to the safety of patients, health care workers, and the general public
    - The role and availability of clinical trial participation as a therapeutic option in appropriate situations
    - Apply the lifelong learning skills of the Scholar Role to implement a personal program to keep up-to-date and enhance areas of professional competence
    - Contribute to the enhancement of quality care and patient safety in radiation oncology, integrating the available best evidence and best practices

3. Perform a complete and appropriate assessment of a patient
    - Identify and explore issues to be addressed in a patient encounter effectively, including the patient's context and preferences
    - Elicit a history that is relevant, concise, and accurate to context and preferences for the purposes of prevention and health promotion, diagnosis, and/or management
    - Perform a focused physical examination that is relevant and accurate for the purposes of prevention and health promotion, diagnosis and/or management
    - Select medically appropriate investigations in a resource-effective and ethical manner
    - Demonstrate effective clinical problem-solving and judgment to address patient problems, including interpreting available data and integrating information to generate differential diagnoses and management plans

- Demonstrate independent care of ambulatory and hospitalized patients in all aspects of radiation oncology, including investigation, diagnosis, treatment planning, supervision of radiation therapy, and the ongoing care of patients who have received radiation therapy and/or treatment for malignant disease
- Recognize and treat oncologic emergencies effectively

4. Use preventive and therapeutic interventions effectively
   - Implement an effective management plan in collaboration with a patient and the patient's family
   - Apply knowledge of the outcomes of various treatment methods, including the interpretation of clinical trials and statistical analysis, to the management of the patient
   - Demonstrate competent planning and execution of radiation therapy, which involves, but is not limited to, the following components:
   - ○ Integrate knowledge from relevant clinical examinations and imaging to define the tissue volumes to be treated and tissues to be spared
   - ○ Use treatment simulation equipment effectively
   - ○ Collaborate with medical physics and radiation therapy planning personnel
   - ○ Prepare and interpret radiation treatment plans
   - Select the appropriate type of external beam radiation equipment, intra-cavitary and interstitial radiation techniques, and radioisotopes for therapeutic use
   - Demonstrate effective, appropriate, and timely application of preventive and therapeutic interventions relevant to radiation oncology
   - Describe the indications for and complications of various interventions employed alone or in combination in the management of patients, including recognition of the curative and palliative outcomes of specific treatment modalities, including but not limited to the following:
   - Surgery
   - Cytotoxic chemotherapy Hormone therapy
   - Immunotherapy and targeted therapies
   - Pain and symptom management
   - Plan, prescribe, and supervise a course of radiation therapy for patient treatment of superficial and deep-seated tumours
   - Plan, prescribe, and supervise external beam treatments, including inverse planned intensity-modulated radiation therapy (IMRT) and stereotactic radiation treatments for intracranial sites
   - Demonstrate an understanding of the procedures, immobilization, volume determination, and dose schedules for stereotactic body radiotherapy (SBRT)
   - Plan, prescribe and supervise brachytherapy procedures, including cervical, and endometrial brachytherapy
   - Describe the management of other disease sites that may be treated with brachytherapy
   - Describe the management of emergencies and complications of this therapy
   - Describe the management of neoplastic diseases
   - Describe the management of emergencies and complications of this therapy
   - Ensure informed consent is obtained and appropriately documented for therapies

- Ensure patients receive appropriate management of co-morbidities and end-of-life care, including assisting patients and families in accessing relevant community resources
- Recognize the opportunity and demonstrate the ability to offer clinical trial participation as a therapeutic option in an appropriate and ethical manner

5. Demonstrate the proficient and appropriate use of procedural skills for diagnosis and therapy
   - Demonstrate effective, appropriate, and timely use and interpretation of diagnostic procedures relevant to radiation oncology, including but not limited to the following:
   - ○ Ear, nose, and throat endoscopy
   - ○ Gynaecologic examination
   - Demonstrate effective, appropriate, and timely performance of therapeutic procedures relevant to radiation oncology
   - Ensure informed consent is obtained and appropriately documented for procedures
   - Document and describe information related to procedures performed and their outcomes
   - Ensure adequate follow-up is arranged for procedures performed

6. Recognize the limits of their own expertise and seek appropriate consultation from other health professionals
   - Demonstrate insight into their own limits of expertise
   - Demonstrate effective, appropriate, and timely consultation with other health professionals as needed for optimal patient care
   - Arrange appropriate follow-up care for patients and their families

Communicator

Definition:

As communicators, radiation oncologists effectively facilitate the doctor-patient relationship and the dynamic exchanges that occur before, during, and after the medical encounter.

Key and enabling competencies: radiation oncologists are able to…

1. Develop rapport, trust, and ethical therapeutic relationships with patients and families
   - Recognize that good communication is an essential clinical skill for physicians, and that effective physician-patient communication can foster patient satisfaction, physician satisfaction, adherence to recommended therapies and improved clinical outcomes
   - Establish positive therapeutic relationships with patients and their families that are characterized by understanding, trust, respect, honesty, and empathy
   - Respect patient confidentiality, privacy and autonomy
   - Listen effectively
   - Be aware of and responsive to non-verbal cues
   - Facilitate a structured clinical encounter effectively
2. Accurately elicit and synthesize relevant information and perspectives of patients and families, colleagues, and other professionals
   - Gather information about a disease and about a patient's beliefs, concerns, expectations, and illness experience
   - Describe the impact of such factors as age, gender, disability, ethno-cultural background, social support, and emotional influences on a patient's illness

- Support and counsel a patient about end-of-life care and appropriate palliative care referral, and identify the need for and strategies to access bereavement counselling
- Seek out and synthesize relevant information from other sources, including a patient's family, caregivers, and other professionals

3. Convey relevant information and explanations accurately to patients and families, colleagues and other professionals
   - Deliver information to a patient and family, colleagues, and other professionals in a humane manner and in such a way that it is understandable and encourages discussion and participation in decision-making
   - Describe the opportunity to participate in a clinical trial, including the ability to convey and manage medical uncertainty
4. Develop a common understanding of issues, problems, and plans with patients, families, and other professionals to develop a shared plan of care
   - Identify and explore problems to be addressed from a patient encounter effectively, including the patient's context, responses, concerns, and preferences
   - Respect diversity and difference, including but not limited to the impact of gender, religion, and cultural beliefs on decision-making
   - Encourage discussion, questions, and interaction in the encounter
   - Engage patients, families, and relevant health professionals in shared decision-making to develop a plan of care
   - Address challenging communication issues effectively, including obtaining informed consent, delivering bad news, and addressing anger, confusion, and misunderstanding
5. Convey effective oral and written information about a medical encounter
   - Produce clear, concise, accurate, reasoned, timely, and appropriate records of clinical encounters and plans
   - Present verbal reports of clinical encounters and plans effectively
   - Present the patient's problems clearly, concisely, and correctly in a clinical setting or formal presentation
   - Present medical information effectively to the public or media about a medical issue

Collaborator

Definition

As collaborators, radiation oncologists effectively work within a health care team to achieve optimal patient care.

Key and enabling competencies: radiation oncologists are able to…

1. Participate effectively and appropriately in an inter-professional health care team
   - Describe the radiation oncologist's roles and responsibilities to other professionals
   - Describe the roles and responsibilities of other professionals within the health care team, including but not limited to treatment planners, medical physicists, radiation therapists, radiation therapy nurses, and other physician specialists
   - Recognize and respect the diversity of roles, responsibilities, and competencies of other professionals in relation to their own

- Demonstrate open-mindedness in the consideration of alternative and complementary healthcare practices
- Work with others to assess, plan, provide, and integrate care for individuals and groups of patients
- Work with others to assess, plan, provide, and review other tasks, including research problems, educational work, program review or administrative responsibilities
    - Participate effectively in inter-professional team meetings including tumour boards
    - Enter into interdependent relationships with other professions for the provision of quality care
    - Describe the principles of team dynamics
    - Respect team ethics, including confidentiality, resource allocation, and professionalism
    - Demonstrate leadership in a health care team, as appropriate

2. Work with other health professionals effectively to prevent, negotiate, and resolve inter-professional conflict

- Demonstrate a respectful attitude toward other colleagues and members of an inter-professional team
- Work with other professionals to prevent conflicts
- Employ collaborative negotiation to resolve conflicts
- Respect differences and address misunderstandings and limitations in oneself and other professionals
- Recognize one's own differences, misunderstandings, and limitations that may contribute to inter-professional tension
- Reflect on inter-professional team functions and suggest or implement appropriate changes

Manager

Definition

As managers, radiation oncologists are integral participants in health care organizations, organizing sustainable practices, making decisions about allocating resources, and contributing to the effectiveness of the health care system.

Key and enabling competencies: radiation oncologists are able to…

1. Participate in activities that contribute to the effectiveness of their health care organizations and systems

- Work collaboratively with others in their organizations
- Explain the importance of shared responsibility for health care provision in a multidisciplinary and inter-professional setting, and in continuing care in the community
- Participate in systematic quality process evaluation and improvement, including patient safety initiatives
- Contribute to the enhancement of quality care and patient safety in radiation oncology, integrating the available best evidence and best practices
- Describe the process required for a facility to be accredited to use ionizing radiation
- Participate in audits, quality improvement, risk management, occurrence/incident reporting, and complaint management in a hospital and ambulatory setting

- Define cost/benefit ratios, cost containment, effectiveness, and efficiency as they relate to the choice of preventive or diagnostic/therapeutic interventions
- Describe the structure and function of the health care system as it relates to radiation oncology, including the roles of physicians
- Describe principles of health care financing, including physician remuneration, budgeting, and organizational funding
- Describe factors that need to be considered in planning for the population's needs for human and facility resources relevant to ensuring appropriate access to radiation therapy services

2. Manage their radiation oncology practice and career effectively
   - Set priorities and manage time to balance patient care, practice requirements, outside activities, and personal life
   - Demonstrate the importance of punctuality and time management, especially when working in a team environment
   - Manage a practice, including finances and human resources
   - Implement strategies to ensure personal practice improvement
   - Employ information technology appropriately for patient care
3. Allocate finite health care resources appropriately
   - Recognize the importance of just allocation of healthcare resources, balancing effectiveness, efficiency, and access with optimal patient care
   - Discuss the advantages, disadvantages, and relative costs of prevention, screening, and therapeutic cancer programs
   - Compare the advantages, disadvantages, and relative costs of care in different settings, including the role of the various forms of health care provision, including hospitals, regional cancer centres, ambulatory clinics, private offices, home care, chronic care, and palliative care
   - Avoid unnecessary investigations and hospitalization
   - Apply evidence and management processes for cost-appropriate care
   - Participate in cost-effectiveness and quality assurance programs
   - Make judicious use of complex technologies
   - Demonstrate an understanding of the relative cost of newer technologies and the supportive evidence for their application

4. Serve in administration and leadership roles, as appropriate
   - Chair or participate effectively in committees and meetings
   - Lead or participate in the implementation of change in healthcare
   - Plan relevant elements of health care delivery (e.g., work schedules)

Health Advocate

Definition

As health advocates, radiation oncologists responsibly use their expertise and influence to advance the health and well-being of individual patients, communities, and populations.

Key and enabling competencies: radiation oncologists are able to…

1. Respond to individual patient health needs and issues as part of patient care
   - Identify the health needs of an individual patient

- Identify opportunities for advocacy, health promotion and disease prevention with individuals to whom they provide care, including but not limited to smoking cessation, preventing and managing obesity, and exercise programs
- Identify opportunities for advocacy with regard to patient safety
- Describe strategies to facilitate access to relevant community resources for patients and families
- Appreciate the possibility of competing interests between individual advocacy issues and the community at large

2. Respond to the health needs of the communities that they serve
   - Describe the practice communities that they serve
   - Identify opportunities for advocacy, health promotion, and disease prevention in the communities that they serve, and respond appropriately
   - Appreciate the possibility and problems of competing interests, including their own, within the communities served
3. Identify the determinants of health for the populations that they serve
   - Identify the determinants of health, including barriers to access to care and resources
   - Identify vulnerable or marginalized populations within those served and respond appropriately
4. Promote the health of individual patients, communities, and populations
   - Describe an approach to implementing change in a determinant of the health of the population they serve
   - Describe how public policy impacts on the health of the populations served
   - Identify points of influence in the health care system and its structure
   - Describe the ethical and professional issues inherent in health advocacy, including altruism, social justice, autonomy, integrity, idealism, and conflicts of interest
   - Appreciate the possibility of a conflict of interest between the role of a health advocate for a patient or community and that of a manager or gatekeeper
   - Describe the role of the medical profession in advocating collectively for health and patient safety
   - Describe the advocacy role of the profession for issues related to radiation protection

Scholar

Definition

As scholars, radiation oncologists demonstrate a lifelong commitment to reflective learning, as well as the creation, dissemination, application, and translation of medical knowledge.

Key and enabling competencies: radiation oncologists are able to…

1. Maintain and enhance professional activities through ongoing learning
   - Describe the principles of maintenance of competence
   - Describe the principles and strategies for implementing a personal knowledge- management system
   - Recognize and reflect upon learning issues in practice
   - Conduct a personal practice audit
   - Pose an appropriate learning question

- Access and interpret the relevant evidence
- Integrate new learning into practice
- Evaluate the impact of a change in practice
- Document the learning process

2. Critically evaluate medical information and its sources, and apply this appropriately to practice decisions
   - Describe the principles of critical appraisal
   - Critically appraise retrieved evidence in order to address a clinical question
   - Integrate critical appraisal conclusions into clinical care
3. Facilitate the learning of patients, families, students, fellows, other health professionals, the public, and others, as appropriate
   - Describe principles of learning relevant to medical education
   - Identify the learning needs and desired learning outcomes of others collaboratively
   - Select effective teaching strategies and content to facilitate others' learning
   - Demonstrate an effective lecture or presentation
   - Assess and reflect on a teaching encounter
   - Provide effective feedback
   - Describe the principles of ethics with respect to teaching
4. Contribute to the development, dissemination, and translation of new knowledge and practices
   - Describe the principles of research and scholarly inquiry
   - Describe the principles of research ethics
   - Pose a scholarly question
   - Conduct a systematic search for evidence
   - Select and apply appropriate methods to address the question
   - Disseminate the findings of a study
   - Recognize and offer participation in a clinical trial in appropriate situations
   - Demonstrate knowledge of the principles of radiation oncology through completion of a scholarly project related to radiation oncology

Professional

Definition:

As professionals, radiation oncologists are committed to the health and well-being of individuals and society through ethical practice, profession-led regulation, and high personal standards of behavior.

Key and enabling competencies: radiation oncologists are able to…

1. Demonstrate a commitment to their patients, profession, and society through ethical practice
   - Exhibit appropriate professional behaviours in practice, including honesty, integrity, commitment, compassion, respect, and altruism
   - Demonstrate trustworthiness (honesty, confidentiality) toward patients, families, and colleagues
   - Demonstrate a commitment to delivering the highest quality care and maintenance of competence, including involvement in peer review processes
   - Recognize and respond appropriately to ethical issues encountered in practice

- Describe the basic principles and problems in medical ethics, including respect for persons/autonomy, beneficence, non-maleficence, justice, confidentiality, the best interest of the patient, truth-telling, conflict of interest, end-of-life care, advance directives, and resource allocation
- Demonstrate tolerance for ambiguity and uncertainty, and the possibility of error in ethical decision-making
- Recognize and manage conflicts of interest
- Recognize the principles and limits of patient confidentiality as defined by professional practice standards and the law
- Maintain appropriate relations with patients

2. Demonstrate a commitment to their patients, profession and society through participation in profession-led regulation
   - Demonstrate knowledge and an understanding of the professional, legal and ethical codes of practice
   - Fulfil the regulatory and legal obligations required of current medico-legal practice
   - Describe the principles of medico-legal liability, including fiduciary responsibility, duty of care, breach of duty, standard of care and harm
   - Explain the principles of research ethics
   - Demonstrate accountability to professional regulatory bodies
   - Recognize and respond to others' unprofessional behaviours in practice
   - Participate in peer review

3. Demonstrate a commitment to physician health and sustainable practice
   - Balance personal and professional priorities to ensure personal health and a sustainable practice
   - Strive to heighten personal and professional awareness, and insight
   - Demonstrate a willingness to accept peer and supervisor reviews of professional competence
   - Recognize other professionals in need and respond appropriately

5 TRAINING APPROACH

5.1 Training methods

Our training goal is to ensure maximum learning and interaction with the facilitator to enable a fruitful learning process and therefore we shall employ a hybrid approach in which innovative teaching methods such as e-Learning shall be encouraged while retaining a minimum of traditional teaching approaches (70% innovative methods to 30% traditional).

5.1.1 Didactic Lectures

These will give theoretical knowledge in applied clinical anatomy, applied physiology, applied pathology, medical physics, biostatistics, radiobiology, imaging techniques, radiotherapy treatment techniques and planning, basic principles and practice of radiation oncology, and the principles of chemotherapy.

5.1.2 Clinical Apprenticeship

The Fellow will be assigned to the consultant for a training block in the clinic during which the trainee will be supervised and supported with patient evaluation, decision making, treatment simulation and planning, carrying out brachytherapy, and chemotherapy treatments. The Fellow will also be expected to prepare a case report to interesting/unique patient encounters for further discussion and assessment by the consultant. The trainee should acquire both adequate knowledge and clinical skills in the management of that disease/site. To acquire sufficient clinical skills a minimum number of patients should be treated by the Fellow under qualified supervision. The number of patients seen by a Fellow is defined as the equivalent to a completely treated patient from the first visit until follow-up ('full case equivalent'). Each Fellow should see at least 500 full case equivalents during the total clinical radiation oncology training course and rotations. The Fellow will be familiar with all aspects of brachytherapy planning, treatment, and supervision, including demonstrating familiarity with those tasks of the brachytherapy treatment which are normally performed by the radiation oncologist.

5.1.3 Tutorials

Fellows will hold weekly tutorials with their consultant during which they will present and discuss the case(s), to understand the synthesis of clinical data, decision-making, and execution of effective radiotherapy treatment plans, based on a firm understanding of local treatment guidelines and in the context of available evidence.

Fellows will be encouraged to undertake extensive self-directed learning and research during the preparation process for tutorials.

5.1.4 Case reports

A guided description and write-up of cases documented with pictures planning/simulation films will be expected per level. Each case write-up will be selected to depict the Fellow’s level of participation and highlight the appropriateness of the modalities used. These cases will be examined and marked and will contribute to the overall assessment of the Fellow.

Fellows will be required to complete a minimum of 30 case reports prior to sitting their Part 2 examinations. A list of these case reports will be captured in the learner’s log book. The format of the case report is attached on the appendix. Fellows will be required to compete a case report for early month of training, and submitted to the respective consultant for appraisal.

During each block, the fellow will be guided by the consultant on major areas for which a case report is mandatory, and less relevant for minor areas of that discipline as outlines below.

Rotation	Major area	Minor Areas
Breast Oncology	Breast Cancer	
Thoracic Oncology	Non-Small Cell Lung Cancer Small Cell Lung Cancer Superior Vena Caval Obstruction	Mesothelioma Thymoma
Head and Neck Oncology	Mucosal Cancers Salivary gland cancers Head and Neck Cancer of unknown primary site Thyroid cancer	Glomus Tumours Orbital Tumours
Skin and Soft Tissue Oncology	Non-Melanoma Skin cancer Melanoma Skin Cancer Soft tissue sarcoma Bone Metastases	Kaposi's' Sarcoma Ewing's Sarcoma Osteosarcoma Aggressive Fibromatosis
Genitourinary Oncology	Prostate Cancer Bladder Cancer Penis Cancer Testis Cancer	Renal Cancer Ureteral Cancer
Gynaecology Oncology	Cervix cancer Endometrial Cancer Vulvar Cancer Gestational Trophoblastic Disease	Ovarian Cancer Vaginal Cancer
Gastrointestinal Oncology	Oesophagus Cancer Gastric cancer Pancreatic cancer Rectal Cancer Anal Cancer	Colon cancer Hepatocellular carcinoma Gastrointestinal stromal tumours Hepatobiliary cancers Carcinoid Tumours
Neuro-Oncology	Gliomas Meningioma Pituitary Tumours Cerebral Metastases Malignant Spinal Cord Compression	Ependymoma Pineal Tumours Acoustic Neuroma Vascular Malformations
Haematology Oncology	Hodgkin's Lymphoma Non-Hodgkin's Lymphoma Plasmacytoma	Multiple Myeloma Leukaemia
Paediatric Oncology	Wilms Tumour Medulloblastoma And Primitive Neuroectodermal Tumours Retinoblastoma	

5.1.5 Logbook

A detailed logbook indicating Fellow participation in the management of different cancers will be kept from the beginning to the end of the programme. These will be signed by a qualified Radiation oncologist/supervisor.

5.1.6 Learner Portfolio

The portfolio is a document collection kept by the Fellow in training in which the following items are kept during the duration of the training. The fellow in training keeps the portfolio up-to-date himself/herself and regularly reflect, with others in training and with his/ her tutor (s), upon his competency development. The Portfolio will be submitted before the final Part II examination, and will be marked out of 100% but will contribute 25% of the final examination.

6 TRAINING ROLES & RESPONSIBILITIES

6.1 Training staff

The training will be offered by a multi-disciplinary team of local and international experts in the fields of Clinical and Radiation Oncology, Medical Oncology, Paediatric Oncology, Surgical Oncology, Gynaecological Oncology, and Palliative care

6.1.1 Radiation Oncology teaching staff

The following radiation oncologists will provide training for Fellows

	Name	Qualifications	Role / Employer
1	Dr. Daniel Kanyike Mukasa	DMR, MBCHB, M.Med (Rad Onc), FC Rad Onc (SA)	Consultant Radiation Oncologist, Uganda Cancer Institute
2	Dr. Isreal Luutu	MB.ChB, MMed (Diag Rad), MMed (Rad Onc), FC Rad Onc (SA)	Consultant Radiation Oncologist, Uganda Cancer Institute
3	Dr. Solomon Kibudde	MB.ChB, MMed (Int), MMed (Rad Onc), FC Rad Onc (SA)	Specialist Radiation Oncologists, Uganda Cancer Institute

6.1.2 Medical Physics teaching staff

	Name	Qualifications	Employer
1	Dr. Awusi Kavuma	BSc, M.Sc (Physics), M.Med.Sc, PhD (Medical Physics)	Principal Medical Physicist, Uganda Cancer Institute
2	Mr. Moses Katumba	BSc, M.Sc (Physics)	Senior Medical Physicist, Uganda Cancer Institute
3	Mr. Ignatius Komaketch	BSc, M.Sc (Medical Physics)	Radiation Safety Officer, Uganda Cancer Institute

6.1.3 Practical sessions teaching staff

	Name	Qualifications	Employer
1	Ms Cissy Bangidde Namutale	DMR, NDR (T), BTech Rad (T)	Senior Therapy Radiographer, Uganda Cancer Institute
2	Mr Everisto Katungwesi	DMR, NDR (T), BTech Rad (T)	Senior Therapy Radiographer, Uganda Cancer Institute
3	Mr Martin Seguya	Dip Radiography, BSc. Therapy Radiography	Therapy Radiographer
4	Mr Moses Alinda	Dip Radiography, BSc. Therapy Radiography	Therapy Radiographer
5	Ms Catherine Nakato	Dip Radiography, BSc. Therapy Radiography	Therapy Radiographer
6	Mr Karim Mawerere	Dip Radiography, BSc. Therapy Radiography	Therapy Radiographer

6.1.4 Applied Anatomy and Radiology teaching staff

	Name	Qualifications	Role / Employer

1	Dr. Alfred Bulamu	MBCHB, M.Med (Rad)	Consultant Radiologist, Uganda Cancer Institute
2	Dr. Valeria Nabbossa	MBCHB, M.Med (Rad)	Radiologist, Uganda Cancer Institute
3	Dr. Hassan Kabiito	MBCHB, M.Med (Rad)	Radiologist, Uganda Cancer Institute

6.1.5 Radiobiology teaching staff

	Name	Qualifications	Role / Employer
1	Dr. Daniel Kanyike Mukasa	DMR, MBCHB, M.Med (Rad Onc), FC Rad Onc (SA)	Consultant Radiation Oncologist, Uganda Cancer Institute
2	Dr. Isreal Luutu	MB.ChB, MMed (Diag Rad), MMed (Rad Onc), FC Rad Onc (SA)	Consultant Radiation Oncologist, Uganda Cancer Institute
3	Dr. Solomon Kibudde	MB.ChB, MMed (Int), MMed (Rad Onc), FC Rad Onc (SA)	Specialist Radiation Oncologists, Uganda Cancer Institute
4	Dr. Nixon Niyonzima	MBChB, MSc. PhD	Laboratory Scientist, Uganda Cancer Institute
5	Dr. Awusi Kavuma	BSc, M.Sc (Physics), M.Med.Sc, Ph.D. (Medical Physics)	Principal Medical Physicist, Uganda Cancer Institute

6.1.6 Medical Oncology teaching staff

	Name	Qualifications	Role / Employer
1	Dr. Jackson Orem	MBChB, M.Med(Internal Medicine), PhD	Executive Director, Uganda Cancer Institute
2	Dr. Victoria Walusansa	MBChB, M.Med (Internal Medicine)	Deputy Executive Director, Uganda Cancer Institute
3	Dr. Nixon Niyonzima	MBChB, MSc. PhD	Head, Research and Training, Uganda Cancer Institute
4	Dr. Henry Ddungu	MBChB, M.Med (Internal Medicine)	Haematologist, Uganda Cancer Institute
5	Dr. Fred Okuku	MBChB, M.Med (Internal Medicine)	Genitourinary – Medical Oncologist, Uganda Cancer Institute
6	Dr. Abrahams Omoding	MBChB, M.Med (Internal Medicine)	Haemato-oncologist, Uganda Cancer Institute
7	Dr. Siraji Obayo	MBChB, M.Med (Internal Medicine)	Gastrointestinal – Medical Oncologist, Uganda Cancer Institute
8	Dr. Alex Bakenga	MBChB, M.Med (Internal Medicine)	Genitourinary – Medical Oncologist, Uganda Cancer Institute

9	Dr. Joanne Kayaga	MBChB, M.Med (Internal Medicine)	Gastrointestinal – Medical Oncologist, Uganda Cancer Institute
10	Dr. Dove Clement Okello	MBChB, M.Med (Internal Medicine)	Haematologist, Uganda Cancer Institute
11	Dr Joyce Balagadde Kambugu	MBChB, M.Med (Paediatrics)	Head, Paediatric Oncology, Uganda Cancer Institute
12	Dr. Fadhil Geriga	MBChB, M.Med (Paediatrics)	Paediatric Oncologist, Uganda Cancer Institute

6.2 Support staff

	Name	Qualifications	Employer
1	Programme Director	MBChB, MMed (Rad Onc) or its equivalent	Uganda Cancer Institute
2	Secretary	Dip Secretarial	Uganda Cancer Institute
3	Finance Officer	BSc	Uganda Cancer Institute
4	Programme Coordinator	MBChB, MMed (Rad Onc) or its equivalent	Uganda Cancer Institute
5	Examinations Officer	BSc	Uganda Cancer Institute

Students with disabilities and gender issues

7 TRAINING INFRASTRUCTURE

7.1 Training facilities

The programme will be hosted by the department of radiotherapy at the Uganda Cancer Institute. The following facilities are available to support training

	Facility	Capacity	Quantity / Planned
1	Lecture room	25-seater	2 rooms are available
2	Board room	15-seater	2 rooms are available
3	Conference room	25-seater	2 rooms with audio-visual facilities
4	Tutorial rooms	10-seater	3 rooms are available
5	Clinical rooms	Consultation space	7 offices are available
6	Fellow room	15-seater	1 room is available
7	Library	Limited capacity	1 reference library is available

7.2 Training equipment

The Uganda Cancer Institute department of radiotherapy is well-equipped to successfully deliver a robust radiation oncology training program. The following equipment is already available and in active use.

	Equipment	Quantity	Description
1	Linear Accelerators	1	Varian Truebeam, with a range of photon and electron energies
2	Cobalt Teletherapy	2	Megavoltage unit for external beam treatment
3	Brachytherapy units	1	High dose rate after loader for intracavitary, interstitial, intraluminal, and cylinders
4	CT Simulator	1	3D-CRT, IMRT, SBRT, SRS planning
5	Conventional Simulators	1	2D radiotherapy planning
6	Mold rooms	2	1-room equipped and in use
7	Treatment Planning systems	1	Eclipse
8	Physics Laboratory	1	Equipment is available
9	Radiobiology Laboratory	0	Under construction; anticipated to stimulate radiation research
10	Imaging	1	Ultrasound, X-ray, Mammography, and diagnostic CT services
11	Radiation protection equipment	N/A	Radiation safety officer in place, with regular issuance of radiation monitoring badges

7.3 Training Environment

The UCI has several training resources within the department of radiotherapy, these include;

7.3.1 UCI/FHCRC case conferences,

The UCI/FHCRC case conferences are held monthly via a virtual platform and provide external consultant input towards clinical care of patients at the UCI

7.3.2 Weekly chart review

The department holds weekly chart review sessions to check patient assessment, radiotherapy planning and to gather collective input regarding difficult decisions impacting care. This platform supplements the quality assurance measures within the department.

7.3.3 Journal clubs

We have weekly journal club sessions on Friday afternoon. These sessions aim to discuss two recently (within the last 6 months) published Part 3 trials and meta-analysis; as a measure to keep a brace with advances in radiation oncology.

7.3.4 Academic seminars

An academic session is conducted weekly with a focus on clinical case management in light of departmental protocols. This session aims to enhance scientific reasoning and application of departmental treatment protocols

7.3.5 Multidisciplinary tumour boards

The UCI has several ongoing weekly tumour boards. These provide the opportunity for the Fellow to interact with other specialists. The main challenge has been the lack of adequate radiation oncologists to attend these for an as listed below;

	Weekday / Time	Tumour board sessions
1	Tuesday/08h00 – 09h00	Paediatric Oncology Tumour board Gastrointestinal Oncology Tumour board
2	Wednesday/ 08h00 – 09h00	Head and Neck Oncology MDT Urological Oncology MDT
3	Thursday/08h00 – 09h00	Breast Oncology Tumour Board Gynaecological Oncology Tumour Board
4	Friday/08h00 – 09h00	Paediatric Oncology Tumour board Head and Neck Oncology MDT

7.3.6 Other fellowship programs

The UCI already has three well-established fellowship programs. It is anticipated that the training mix of different Fellows will catalyse a multidisciplinary approach to care. These programmes include;

- Paediatric Oncology Training Fellowship
- Gynecological Oncology Training Fellowship
- Adult Haematology and Oncology Training Fellowship

7.3.7 External Support

The local training program for clinical radiation oncologists will attract external support from some existing projects supported by the International Atomic Energy Agency. These projects include;

i) RAF 6056: Supporting human resource development in radiation medicine. The project objective is to strengthen the treatment of cancer through the training and education of radiation medicine professionals in Africa states

ii) RAF 6055: Improving the quality of Radiotherapy in the treatment of frequently occurring cancers. The project objective is to enhance the quality of the delivery of radiotherapy services in Africa through harmonized clinical training schemes and sensitization of policymakers.

iii) UGA 6021: Establishing access to conformal radiotherapy. the project objective is to enhance radiotherapy services in Uganda by establishing safe and effective conformal radiotherapy

iv) RAF 6053: Enhancing Capacity Building of Medical Physicists to Improve Safety and Effectiveness of Medical Imaging. The project objective is to improve the overall safety and effectiveness of diagnostic radiology and nuclear medicine services in Africa through dose optimization and appropriate quality assurance program conducted by Medical Physicists.

v) UGA 6019: Strengthening Nuclear Medicine services – Part II. The project objective is to strengthen and consolidate the existing nuclear medicine facility at Mulago Hospital for the diagnosis and treatment of cancer patients and other diseases

The external support from these projects will be used for:

a) Sending experts to support the local staff to get started with the training program
b) setting up cancer-related (radiation oncology, medical physics, radiotherapy technologists, and nuclear medicine) library with the most essential reference books
c) procure more essential QA/QC equipment
d) Sending external examiners and related support

7.4 The F Rad Onc Training System

The academic training of Radiation Oncology shall include all clinical disciplines, i.e., radiation oncology, chemotherapy, radiology, nuclear medicine, hormonal therapy, targeted therapy, and public health as it is applied to the clinical environment. This curriculum provides for student-centered learning and encourages critical thinking/problem-solving. It advocates for the integration of learning experiences. It also includes non-traditional subjects like management, basic principles in research and communication. Fellows will undergo two examination sets, namely Primaries (Part I – F Rad Onc) by 18 months of training and the final (Part II – F Rad Onc) by 36 months of the training programme. At the end of the four years, all candidates will be required to sit written, oral and practical examinations (where applicable) for each course.

7.4.1 Training Programme structure

	Part I – Basic Sciences		Part II – Clinical Oncology I and II	
Blocks	Year 1	Year 2	Year 3	Year 4
1	Radiology	GI Oncology I		
2	Applied Anatomy	GYN Oncology I		
3	Radiobiology	H/N Oncology I		
4	Medical Physics	Breast Oncology I		
5	Nuclear Medicine	Haem Oncology		
6	Research Project	Thoracic Oncology I		
7	Skin and Soft-Tissue Oncology			
8	Paediatric Oncology			
9	Palliative Medicine	H/N Oncology II		
10	Medical Oncology	Breast Oncology II		
11	Palliative Medicine	Neuro Oncology		
12	Medical Oncology	Thoracic Oncology II		
13	Medical Physics / Treatment Planning II		Research Project II	
14			GI Oncology II	
15			GYN Oncology II	
16			Electives	

7.5 Rotations and the Curriculum

7.5.1 BASIC SCIENCE CORE SPECIALTY ROTATIONS

These were developed with consideration to the Royal College of Physicians and Surgeons of Canada's *Specialty Training Requirements in Radiation Oncology* (v. 2012) and the American Board of Radiology *Certification Requirements.* Competencies of core specialty topics are described below:

7.5.1.1 Radiobiology

Radiation Oncology Objectives for Competency in Radiobiology

- **Medical Expert**

The fellow will develop a good understanding of radiation biology underlying the practice of radiation oncology. The aim of the course is for the fellow to:

1. Understand how ionizing radiation interacts with matter, and its direct and indirect action
2. Understand the molecular and cellular damage induced by radiation and how it can be measured.
3. Understand the molecular and cellular response to radiation damage including mechanisms of DNA damage repair, mechanisms of cell death, cell survival, and models for quantifying cell survival
4. Understand linear energy transfer (LET), relative biological effectiveness (RBE), oxygen effect and influence of the tumor microenvironment.
5. Learn the linear-quadratic model for measuring cell survival and its application to radiation fractionation; apply the knowledge to modified fractionation and understand its clinical implication.
6. Understand the dose-response relationship in radiotherapy: tumor control probability (TCP), normal tissue complication probability (NTCP), and maximizing the therapeutic index.
7. Develop a practical understanding of the radiobiological aspects of different radiation modalities (e.g., protons, high LET sources, stereotactic radiotherapy) as well as the dose- rate effects of brachytherapy.
8. Develop comprehensive understating of the effect of radiation on normal tissue, its pathogenesis, clinically relevant manifestations (early and late effects, radiation-induced malignancies), and its management.
9. Understand the interaction of radiation with chemotherapy and other biological response modifiers.

- **Communicator**

The fellow will be able to:

1. Develop a professional rapport with the radiobiologist
2. Accurately convey relevant information and explanations to colleagues and coworkers
3. Effectively convey oral and written information about the knowledge acquired during the course

- **Collaborator**

The fellow will be able to:

1. Share knowledge and information with other fellows
2. Develop organizational structures that facilitate effective learning of the course objective
3. Understand the roles of the radiobiologist in the field of radiation oncology

- **Manager**

The fellow will be able to:

1. Develop time management skills allowing him/her to achieve the objectives stated within the specified time frame

- **Scholar**

The fellow will be able to:

1. Apply the knowledge acquired to clinical radiation oncology
2. Accept feedback received

- **Professional**

The fellow will be able to:

1. Exhibit a professional approach with staff
2. Be punctual and dependable

- **Structure**

Twelve months will be dedicated to the understanding of radiobiology this will be delivered as lectures or tutorials by a radiation oncologist or radiobiologist or radiation therapy medical physicist.

- **Evaluation**

Written formative assessment will be conducted after completion of the course. All trainees must attain minimum competency in the summative assessment.

7.5.1.2 Radiation therapy Medical Physics

Radiation Oncology Objectives for Competency in Radiation Therapy Physics

- **Medical Expert**

The fellow will develop a good understanding of radiation physics underlying the practice of radiation oncology. The aim of the first course is to develop a good understanding of the principles of radioactivity, radiation production, radiation measurement and dosimetry, and radiation safety and protection.

The fellow should develop adequate knowledge to explain the following concepts (adapted from American Board of Radiology (ABR) requirements):

1. Atomic and nuclear structure
    a. Bohr model of the atom, electron transitions, and characteristic radiation
    b. Nuclear structure, nuclear forces, and mass/energy relationships
    c. Factors affecting nuclear stability
    d. Nuclear nomenclature
2. Radioactivity
    a. Modes of radioactive decay
    b. Decay schemes and properties for therapeutic isotopes
    c. Mathematics of radioactive decay
    d. Naturally occurring radioisotopes

e. Nuclear activation, fusion, fission

3. Particle interactions and production of radiation
   a. Mass, energy, and charge relationships
   b. Electromagnetic radiation
   c. Production of radiation
   d. Interactions of particulate radiation with matter
4. Treatment machines
   a. Linear accelerators
   b. Other particle accelerators
   c. Cobalt units
   d. Low energy therapeutic x-rays (< 300 kV)
   e. Treatment machine quality assurance
5. Photon interactions
   a. Coherent scatter
   b. Photoelectric effect
   c. Compton effect
   d. Pair production
   e. Photonuclear disintegration
   f. Relative dependence on Z, E, and density
6. Radiation measurement and calibration
   a. Exposure (air kerma)
   b. Absorbed dose and kerma
   c. Dose equivalent/effective dose equivalent (radiation quality and tissue weighting factors)
   d. Calculation of absorbed dose from exposure (e.g., f-factor)
   e. Bragg-Gray cavity theory
   f. Ionization chambers
   g. Calibration of photon and electron beams (e.g., TG-51)
   h. Other dosimetry techniques (thermoluminescence dosimetry/optically stimulated luminescence dosimetry, film, solid-state diodes, other gas-filled detectors, scintillation detectors, chemical dosimetry, calorimetry)
   i. Measurement techniques
7. Radiation beam quality
   a. Mathematics of exponential attenuation
   b. Beam quality for heteroenergetic beams
8. Dosimetry of photon beams in a homogeneous water phantom
   a. Dose distributions
   b. Flattening filters and flattening-filter free beams
   c. Dose distributions for multiple unshaped beams
   d. Tissue-air ratio (TAR), tissue-maximum ratio (TMR), and tissue-phantom ratio (TPR)
   e. Relationships between percent depth dose (PDD), TAR, TMR, and TPR
   f. Point-dose and treatment-time calculation methods for single unshaped fields
   g. Point-dose and treatment-time calculations for single-shaped fields
   h. Isodose distributions for multiple fields, including arc therapy
9. Dosimetry of photon beams in a patient

a. Corrections for patient contour
b. Corrections for tissue inhomogeneities
c. Dose within and around an inhomogeneity
d. Matching of adjacent fields
e. Wedges
f. Parallel-opposed beams
g. Entrance dose and exit dose, including beam-modifying devices
h. Isodose distributions for multiple beams, including mixed modality and arc therapy
i. Compensators for photon beams
j. Off-axis factors

10. Electron beam characteristics and dosimetry
    a. Dose distributions
    b. Factors affecting dose distributions
    c. Energy specification
    d. Choice of energy and field size
    e. Air gaps and oblique incidence
    f. Tissue inhomogeneities
    g. Bolus, absorbers, and spoilers
    h. Matching adjacent fields
    i. Point-dose and treatment-time calculations
    j. Field-shaping techniques
    k. Electron arc
    l. Total skin electron therapy
11. Imaging for radiation oncology
    a. Plane radiography and fluoroscopy for simulation
    b. Portal imaging
    c. Imaging for radiation therapy planning
    d. Isotope imaging
    e. Image processing, digitally reconstructed radiographs (DRRs), and volume rendering
    f. Image registration
12. Brachytherapy
    a. Calculation of dose from a point source
    b. Calculation of dose from a line source
    c. Physical and dosimetric properties of commercial sealed sources and applicators
    d. Implant instrumentation and techniques for low dose rate
    e. Implant instrumentation and techniques for high dose rate, including PDR
    f. Biological implications of dose, dose rate, and fractionation
    g. Calibration and specification of sources
    h. Disseminated (unsealed) sources/total body and organ dosimetry
    i. Acceptance testing and quality assurance
13. Radiation protection
    a. Principles, biological effect models, personnel dose limits, rules, and regulations
    b. Structural shielding design for external beam therapy
    c. Radiation protection for brachytherapy procedures

d. Leak testing of sealed sources
e. Routine radiation surveys
f. Personnel monitoring

i. Protection against non-ionizing radiation

14. Informatics
    a. DICOM
    b. PACS
    c. Networks, storage, and archives
15. Particle beam therapy
    a. Heavy charged particles
    b. Light charged particles, protons
    c. Neutrons
    d. Relative biological effectiveness (RBE) and RBE-weighted dose
    e. Physical and biological implications of particle therapy

- **Communicator**

The fellow will be able to:

1. Develop a professional rapport with other colleagues involved in treatment planning including the radiation oncologist, medical physicist, dosimetrist, and radiation therapist
2. Accurately convey relevant information and explanations to colleagues and coworkers
3. Convey effective oral and written information about the knowledge acquired during the course

- **Collaborator**

The fellow will be able to:

1. Share knowledge and information with other fellows
2. Develop organizational structures that facilitate learning the course objective effectively
3. Understand the roles of the medical physicist in the field of radiation oncology

- **Manager**

The fellow will be able to:

1. Develop time management skills allowing him/her to achieve the objectives stated within the specified time frame

- **Scholar**

The fellow will be able to:

1. Apply the knowledge acquired to clinical radiation oncology
2. Accept feedback received
3. Teach other fellows

- **Professional**

The fellow will be able to:

1. Exhibit a professional approach with staff
2. Be punctual and dependable

- **Structure**

During 12 months of year one, weekly lectures will be given by a radiation medical physicist

- **Evaluation**

Written formative assessment will be performed after completion of the course. All trainees must attain minimum competency in the summative assessment and in laboratory reports.

7.5.1.3 Applied Radiological Anatomy

Radiation Oncology Objectives for Competency in Applied Radiological Anatomy shall be;

- **Medical Expert**

• The fellow will develop a good understanding of applied radiological anatomy underlying the practice of radiation oncology. The aim of the first course is to develop a good understanding of the principles of cross-sectional anatomy, location and relations, surface anatomy (landmarks), possible routes of cancer spread, Neurological pathways, Blood and lymphatic supply and Localization of tumour and critical structures

The fellow should develop adequate knowledge to explain the following concepts:

1. Neuro-Anatomy
   a. Neuro-anatomy Cerebrum,
   b. cerebellum,
   c. brainstem,
   d. ventricular system
   e. Cranial nerves including origin and supply
   f. Spinal cord, cauda equine, meninges
   g. Brachial plexus, sacral plexus Innervation of upper and lower limbs
   h. Autonomic nervous system
2. Head and Neck anatomy
   a. Nasopharynx,
   b. oropharynx,
   c. oral cavity Tongue,
   d. paranasal/facial sinuses,
   e. salivary glands,
   f. larynx, and hypopharynx
   g. thyroid, and parathyroid,
   h. pituitary gland and orbits,
   i. anterior and posterior triangles of the neck,
   j. supraclavicular,
   k. pterygopalatine,
   l. temporal and infratemporal fossae skull base,
   m. vascular and neural foramina

3. Thoracic Anatomy
    a. Mediastinum,
    b. trachea,
    c. main bronchi,
    d. lung
    e. Pleura and pleural cavities,
    f. heart and great vessels,
    g. pericardium,
    h. azygos vein,
    i. esophagus,
    j. thoracic duct,
    k. breast, and chest wall
4. Abdominal cavity
    a. Stomach,
    b. duodenum,
    c. liver,
    d. spleen,
    e. gall bladder and biliary tract

- **Communicator**

The fellow will be able to:

4. Develop a professional rapport with other colleagues involved in treatment planning including the radiation oncologist, medical physicist, dosimetrist, and radiation therapist
5. Accurately convey relevant information and explanations to colleagues and coworkers
6. Convey effective oral and written information about the knowledge acquired during the course

- **Collaborator**

The fellow will be able to:

4. Share knowledge and information with other fellows
5. Develop organizational structures that facilitate learning the course objective effectively
6. Understand the roles of the Radiologist in the field of radiation oncology

- **Manager**

The fellow will be able to:

1. Develop time management skills allowing him/her to achieve the objectives stated within the specified time frame

- **Scholar**

The fellow will be able to:

4. Apply the knowledge acquired to clinical radiation oncology
5. Accept feedback received
6. Teach other fellows

- **Professional**

The fellow will be able to:

3. Exhibit a professional approach with staff
4. Be punctual and dependable

- **Structure**

During 12 months of year one, weekly lectures will be given by a radiologist and/or Anatomist

- **Evaluation**

Written formative assessment will be performed after completion of the course. All trainees must attain minimum competency in the summative assessment and in laboratory reports.

7.5.1.4 Principles of Treatment Planning I

Radiation Oncology Objectives for Competency in Radiation Treatment Planning Principles

- **Medical Expert**

The fellow will develop a good understanding of the principles of treatment simulation, treatment planning, and radiation delivery. The fellow will also learn common treatment techniques for different disease sub-sites.

The fellow should develop adequate knowledge to explain the following concepts.

1. Imaging for radiation oncology
   a. Plane radiography and fluoroscopy for simulation
   b. Portal imaging
   c. Imaging for radiation therapy planning
   d. Isotope imaging
   e. Image processing, digitally reconstructed radiographs (DRRs), and volume rendering
   f. Image registration
2. Treatment planning, international commission on radiation units and measurements (ICRU), and beam-related biology
   a. 3D treatment planning, non-coplanar beams
   b. ICRU concepts
   c. Virtual simulation, including beam's eye view (BEV) techniques
   d. Treatment planning systems
   e. Plan evaluation (dose volume histograms (DVH), normal tissue complication probability (NTCP), tumor control probability (TCP), etc.)
   f. Radiosurgery/stereotactic body radiotherapy (SBRT)
   g. Total body irradiation
3. IMRT, conformal arc, and volumetric modulated arc therapy (VMAT)
   a. IMRT delivery systems
   b. Dose prescriptions and inverse planning
   c. IMRT quality assurance
4. Assessment of patient set-up and verification
   a. Positioning and immobilization methods and devices

b. Treatment verification
c. Imaging for treatment delivery/image-guided radiation therapy (IGRT)
d. Respiratory motion management

5. Brachytherapy
   a. Implant instrumentation and techniques for common disease sites

The aforementioned concepts are taught through clinical scenarios of treatment planning in the different disease sites stated in the core specialty topics.

- **Communicator**

The fellow will be able to:

1. Develop a professional rapport with other colleagues involved in treatment planning including the radiation oncologist, medical physicist, dosimetrist, and radiation therapist
2. Accurately convey relevant information and explanations to colleagues and coworkers
3. Convey effective oral and written information about the knowledge acquired during the course

- **Collaborator**

The fellow will be able to:
Share knowledge and information with other fellows
Develop organizational structures that facilitate learning the course objective effectively Understand the roles of the dosimetrist and medical physicist in the field of radiation oncology

- **Manager**

The fellow will be able to:
1. Develop time management skills allowing him/her to achieve the objectives stated within the specified time frame

- **Scholar**

The fellow will be able to:

1. Apply the knowledge acquired to clinical radiation oncology
2. Accept feedback received
3. Teach other fellows

- **Professional**

The fellow will be able to:

1. Exhibit a professional approach with staff
2. Be punctual and dependable

- **Structure**

Twelve months with one-hour weekly lecture will be dedicated to Treatment planning I in year 1 of Part I

- **Evaluation**

Written and oral formative assessment will be performed after completion of the course. All trainees must attain minimum competency in the summative assessment.

7.5.1.5 Radiation Treatment Planning II

Radiation Oncology Objectives for Competency in Radiation Clinical Treatment Planning

- **Medical Expert**

The fellow will develop a good understanding of clinical treatment planning for different disease sub-sites.

The fellow should develop adequate knowledge to explain the following concepts in all disease sites stated in the core specialty topics:

a. Treatment principles
   - Knowledge of standard dose/fractionation schedules
   - Early and late side effects

b. Treatment planning
   - Immobilization methods and the importance of patient comfort and set-up reproducibility
   - Identification of surgical scars, drain sites, and swellings
   - Determination of gross tumor volume (GTV), clinical target volume (CTV), and planning target volume (PTV)
   - Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
   - Tissue inhomogeneity corrections
   - Compensation for anatomical variations/organ motion in the irradiated volume
   - Dosimetric planning including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
   - Planning using more advanced techniques such as zomotherapy and IMRT
   - The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
   - Verification of treatment delivery, including patient set-up and imaging

- **Communicator**

The fellow will be able to:

1. Develop a professional rapport with other colleagues involved in treatment planning including the radiation oncologist, medical physicist, dosimetrist, and radiation therapist
2. Accurately convey relevant information and explanations to colleagues and coworkers
3. Convey effective oral and written information about the knowledge acquired during the course

- **Collaborator**

The fellow will be able to:

1. Share knowledge and information with other fellows
2. Develop organizational structures that facilitate learning the course objective effectively
3. Understand the roles of the dosimetrist and medical physicist in the field of radiation oncology

- **Manager**

The fellow will be able to:

1. Develop time management skills allowing him/her to achieve the objectives stated within the specified time frame

- **Scholar**

The fellow will be able to:

1. Apply the knowledge acquired to clinical radiation oncology
2. Accept feedback received
3. Teach other fellows

- **Professional**

The fellow will be able to:

1. Exhibit a professional approach with staff
2. Be punctual and dependable

- **Structure**

Twelve months with 1 hour lecture daily in year 3 and 4 of Part II

- **Evaluation**

Case-based objective-structured clinical examination (OSCE) assessment; all trainees must attain minimum competency in the summative assessment.

7.5.2 CLINICAL CORE SPECIALTY ROTATIONS

*Adapted from the University of Alberta and University of Ottawa curricula

7.5.2.1 Breast Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with breast cancer. The breast oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with breast cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the breast cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to breast oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with the following:

1. **Epidemiology**

a. Risk factors for breast cancer such as family history, genetic abnormalities (BRCA1 and BRCA2), benign breast disease, parity, age of menarche and menopause, use of hormone replacement therapy, and prior radiation exposure
b. The incidence of the common types of benign and malignant breast tumors

2. **Anatomy**
   a. Surface anatomy, draining lymphatics, blood supply and nerve supply of the breast and regional lymph nodes
   b. Age and pregnancy-related physiologic changes in the breast
   c. Radiological anatomy of the breast and regional nodes using mammography, ultrasound, CT scan and magnetic resonance imaging (MRI)
3. **Pathology**
   a. Benign and neoplastic lesions of the breast
   b. Normal histology of the breast
   c. The process of carcinogenesis
   d. The classification of neoplastic disease arising in the breast, including epithelial and mesenchymal malignancies using the WHO classification system
   e. The importance of pathological prognostic factors, including histological differentiation, resection margins, the presence of lymphovascular invasion and extent of lymph node involvement on the pathological report.
   f. The process of special stains and studies as well as prognostic implications of hormone receptors and molecular pathology
   g. The use of genomic assays (e.g., OncotypeDx, Mammaprint) prognostic and predictive tools in breast cancer
4. **Prevention:**
   a. Indications of screening and identification of risk groups
   b. Screening methods: mammogram, breast MRI
   c. Risks and benefits of screening and impact on mortality and other health parameters
   d. Other risk reduction methods such as bilateral mastectomy +/- oophorectomy in BRCA- 1/2, hormonal therapy
5. **Diagnostic Imaging**
   a. Indications for mammography, breast ultrasound, and MRI of the breast in screening (both in a normal population and in a high-risk population) and follow-up
   b. Sensitivity and specificity of these imaging modalities
   c. Interventional radiology techniques such as stereotactic biopsy and wire localization for diagnosis of non-palpable lesions
6. **Clinical Presentation**
   a. Natural history of breast cancer and the clinical presentation of local, regional, and metastatic disease
   b. The risk of nodal disease in relation to the size and grade of the primary tumor
   c. The risk of residual axillary disease in the setting of micro metastasis in a sentinel node
7. **Clinical Skills**
   a. A **complete history and physical examination** of the breast and regional nodal areas, recognizing and describing abnormal findings

b. Identification and management of treatment-related side effects of radiation as well as hormonal therapy, including skin reactions and menopausal symptoms

8. **Staging**
   a. TNM categories for breast cancer using the UICC system (8th edition)
   b. The principle of clinical and pathological staging following neoadjuvant systemic therapy
   c. The principle of clinical and pathological staging, as well as the restaging of recurrent disease
9. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
   c. The concept of fractionation and its impact on both tumor control and normal tissue- induced toxicity; such fractionation schedules include concomitant boost and hypofractionation.
10. **Radiation Pathology**
   a. Radiation therapy-induced clinical and pathological changes in normal tissue, both at the histopathological and physiological levels
   b. The impact of other factors such as co-morbidities and/or systemic chemotherapy on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
11. **Radiation Physics**
   a. Properties of photons and electrons
   b. Principles of radiation safety relevant to linear accelerators and brachytherapy
   c. Principles of intensity-modulated radiotherapy including QA
12. **Clinical Trials**
   a. The literature pertaining to breast oncology especially with meta-analyses (Oxford overviews) and randomized clinical trials (NSABP, OCOG, RTOG, EORTC, NCIC) that have impacted our current management in breast oncology
   b. Relevant clinical trials in the center
13. **Medical Oncology**
   a. Chemotherapeutic, hormonal, and molecular agents used in the treatment of breast cancer, as well as the side effect profile of the various agents and the risks or benefits of concurrent radiotherapy treatment
   b. The indications for use of these agents in the neoadjuvant, adjuvant, and metastatic setting
   c. The indications for use of hormonal therapies in breast cancer prevention
14. **Surgical Oncology**
   a. The methods of obtaining histological diagnosis such as fine needle aspiration (FNA), core biopsy, excisional biopsy, and sentinel lymph node biopsy
   b. The principles of surgical management in breast cancer including breast conserving surgery, modified radical mastectomy, sentinel node biopsy, axillary node dissection, and also reconstructive techniques such as TRAM flap and implants
15. **Radiotherapy:**
   a. Treatment principles
      - Knowledge of standard dose/fractionation schedules
      - Early and late side effects
   b. Treatment planning
      - Immobilization methods and the importance of patient comfort and set-up reproducibility
      - Identification of surgical scars, drain sites, and swellings

- Determination of GTV, CTV, and PTV
- Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
- Techniques used to reduce heart dose such as prone position and deep inspiration breath hold (DIBH)
- Tissue inhomogeneity corrections
- Compensation for anatomical variations in the irradiated volume
- Dosimetric planning including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
- Planning using more advance techniques such as tomotherapy and IMRT
- The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
- Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors, and treatment factors) in a patient presenting with breast cancer.*

- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of breast cancer.
- Gain expertise in obtaining a focused history and performing a reliable breast and regional nodal examination. Be able to present findings of the history and exam and outline required staging tests.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of the radiation, obtain informed consent and work with radiotherapy planning and treatment delivery staff for adjuvant radiation treatment of DCIS and early invasive breast cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of the radiation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for adjuvant radiation treatment of node-positive, locally advanced, or inflammatory breast cancer, and recurrent breast cancer.
- Be able to manage acute and late effects of adjuvant breast radiation.
- Have detailed knowledge of literature relevant to breast cancer treatment.
- Be able to discuss current recommendations and controversies regarding breast cancer screening.

7.5.2.2 Neuro-Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with primary or secondary brain tumors. The neuro-oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to treat brain tumor patients in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the neuro-oncology service integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to neuro-oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**
   a. The influence of sex, age, occupation, known etiologic agents and association between genetic syndromes and primary brain tumors (e.g., neurofibromatosis, Von Hippel- Lindau)

a. The relative incidence of the common types of benign and malignant brain tumors (both intra-axial and extra-axial lesions)

c. The primary histologies commonly associated with brain metastases and spinal cord compression due to epidural metastatic disease

2. **Anatomy**
   a. The anatomy (both structural and functional anatomy) of the brain, skull base, and spinal cord.

3. **Pathology**
   a. The WHO grading for gliomas and meningiomas
   b. The clinical biomarkers for specific tumor types such as MGMT methylation status, IDH mutation for malignant glioma and cytogenic abnormalities (e.g., 1p/19q codeletion) for oligodendroglial tumors
   c. CSF evaluation in selected CNS tumors
4. **Diagnostic Imaging**
   a. The normal radiological anatomy of the brain, skull base, and spine
   b. The typical radiological appearance of the common types of benign and malignant brain tumors (both intra-axial and extra-axial lesions) on CT, MRI, and PET scan
   c. The use of different MRI sequences such as T1, T2, and Flair, as well as gadolinium enhancement in the interpretation of CNS lesions
5. **Clinical Presentation**
   a. The natural history of the common types of brain and spinal cord tumors
   b. The clinical presentation according to the site of local involvement, and the probability of craniospinal axis and distant metastatic disease
6. **Clinical Skills**
   a. A complete history and physical examination including complete neurological examination, recognizing and describing abnormal findings
   b. Identification and management of common tumor or treatment-related side effects such as seizures, increased intracranial pressure, DVT, and steroid-induced side effects
   c. Distinguish focal brain injury (necrosis) and more diffuse brain injury (neurocognitive side effects and their histopathologic correlates)

d. Identification of the signs and symptoms of intracranial metastatic disease and spinal cord compression
e. Management of seizures and increased intracranial pressure

7. **Staging**
   a. Neuropathological as well as neuroimaging staging
   b. The importance of other prognostic variables such as age and Karnofsky Performance Status / ECOG Performance status
8. **Radiobiology**
   a. The effect of x-rays on the normal neurologic tissue and the neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed neurological toxicity secondary to irradiation
   c. The concept of radiation dose, fraction size, and treated volume in contributing to these side effects
   d. The rationale of altered fractionation schemes such as hyperfractionation, accelerated fractionation, hypofractionation, stereotactic radiosurgery, and their potential impact on both tumor control and normal nervous tissue toxicity
   e. The principle of radiation-induced secondary malignancies in the central nervous system
9. **Radiation Pathology**
   a. Radiation therapy-induced clinical and pathological changes in the normal neurologic tissue, both at the histopathological and physiological level
   b. The impact of other factors, such as co-morbidities and/or systemic chemotherapy, on the incidence and severity of the radiation-induced pathological changes in the central nervous system
10. **Radiation Physics**
    a. Properties of photons and electrons
    b. Properties of protons and other heavy charged particles
    c. Principles of radiation safety relevant to linear accelerators
    d. Principles of intensity-modulated radiotherapy including QA
11. **Medical Oncology**
    a. Chemotherapeutic and targeted therapies in neuro-oncology, as well as the side effect profile of the various agents and the risks or benefits of concurrent radiotherapy treatment
    b. The indications for use of these agents in the concomitant, neo-adjuvant, and adjuvant setting
12. **Surgical Oncology**
    a. The methods of obtaining histological diagnosis such as stereotactic biopsy
    b. The principles of neurosurgical management of brain and spinal cord tumors such as craniotomy, transsphenoidal pituitary adenectomy, skull base resection, and decompressive laminectomy
    c. Role of surgery: impact of extent of resection, the role of surgery in solitary brain metastasis, indications of surgical intervention in spinal cord compression
13. **Radiotherapy Planning**
    a. Treatment principles
       i. Knowledge of standard dose/fractionation schedules
       ii. The appropriate indications for using stereotactic radiosurgery and stereotactic radiotherapy techniques
    b. Treatment planning
       i. Immobilization methods and the importance of patient comfort and set-up reproducibility

ii. Identification of surgical scars, drain sites, and swellings
iii. Clinical mark-up for palliative whole brain treatment, identify the position of lens, orbit, cribriform plate, and optic nerve on lateral skull x-ray
iv. Stereotactic localization systems
v. Determination of GTV, CTV, and PTV, use of image-fusion to minimize contouring uncertainties
vi. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
vii. Tissue inhomogeneity corrections
viii. Compensation for anatomical variations in the irradiated volume
ix. Dosimetric planning including choice of photon energies, beam arrangement and weighting, use of wedges or other beam modifiers; use of non-coplanar beams in SRS
x. The ICRU recommendations for dose prescriptions for external beam therapy using photons or protons
xi. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with CNS cancer.*

- Gain expertise in obtaining a focused history and performing a reliable neurologic examination. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of CNS cancers.
- Be able to outline treatment options and a treatment recommendation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for adjuvant, radical, and palliative radiation treatment of CNS cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases, particularly patients presenting with recurrent CNS cancer.
- Be able to manage acute and late effects of CNS radiation.
- Have detailed knowledge of literature relevant to CNS cancer treatment.

7.5.2.2.1 Gastrointestinal Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with gastrointestinal (GI) cancer. The GI oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with GI cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the GI cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to GI oncology, with particular emphasis on esophageal, gastric, rectal, and anal cancers. This will enable the trainee to collect and to interpret data and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**
   a. Risk factors for GI cancer such as smoking, diet, family history, viral (HPV) and immune deficiency, hereditary syndromes predisposing the patient to colon cancer
   b. The incidence of GI tumors, by sub-site
2. **Anatomy**
   a. Anatomy, draining lymphatics, blood supply, and nerve supply of the GI sub-sites
   b. The radiological anatomy of the chest, abdomen, and pelvis using plain x-ray, CT scan, MRI, and PET scan
3. **Pathology**
   a. Benign and neoplastic lesions of the GI sub-sites
   b. The normal histology found in the gastrointestinal organs
   c. The process of carcinogenesis, molecular pathways leading to colorectal tumorigenesis (e.g., chromosomal instability, mismatch repair pathway, hypermethylation phenotype)
   d. The classification of neoplastic disease arising from different anatomical GI sub-sites including epithelial and mesenchymal malignancies
   e. The importance of pathological prognostic factors, including histological differentiation, resection margins, the presence of perineural, lymphovascular invasion, and nodal involvement on the pathological report
   f. The principle of molecular pathology including important growth factors receptors and different tumor markers
4. **Prevention**
   a. Indications of screening and identification of risk groups
   b. Screening methods: fecal occult blood, sigmoidoscopy, colonoscopy in colorectal cancer
   c. Risks and benefits of screening and impact on mortality
5. **Diagnostic Imaging**
   a. The use of different radiological modalities, particularly endorectal and esophageal US, CT scan, MRI, and PET scan needed for accurate staging of a patient with GI cancer
6. **Clinical Presentation**
   a. The natural history of each disease site
   b. The clinical presentation of local, regional, and metastatic disease; patterns of spread (local, lymphatic, hematogenous, peritoneal)
   c. The risk of nodal disease in relation to the anatomical site and stage of the disease
7. **Clinical Skills**

a. A complete history and physical examination pertinent to a patient with GI cancer, particularly DRE in the assessment of rectal and anal canal cancer and assessment of nutritional status in a patient with esophageal cancer
b. Identification and management of treatment-related side effects of therapy, including skin reactions, weight loss, nausea and vomiting, diarrhea, and metabolic abnormalities
c. Recognize and manage disease complications such as fistulas, bowel incontinence, rectal bleeding, and obstruction of GI tract

8. **Staging**
   a. TNM categories and stage sub-grouping for GI cancer using the UICC system (8th edition)
   b. The principle of clinical and pathological staging, as well as the restaging of recurrent disease
9. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
   c. The concept of fractionation and its impact on both tumor control and the normal tissue- induced toxicity for external beam therapy
   d. The normal and malignant tissue effects related to dose rate in brachytherapy
   e. The principle of radiation-induced malignancies
10. **Radiation Pathology**
    a. Radiation therapy-induced clinical and pathological changes in normal tissue, both at the histopathological and physiological levels
    b. The impact of other factors, such as co-morbidities and/or systemic chemotherapy, on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
11. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy including QA
12. **Clinical Trials**
    a. The literature pertaining to GI oncology, especially with randomized clinical trials (RTOG, EORTC, NCIC) that have impacted our current management in GI oncology
    b. Relevant clinical trials in the center
13. **Medical Oncology**
    a. Systemic chemotherapy and targeted therapy in the context of GI oncology, especially 5FU, cisplatin, mitomycin C, capecitabine, oxaliplatin,
    b. The array of chemotherapeutic and molecular agents used in the treatment of GI cancers, as well as the side effect profile of the various agents and the risks or benefits of concurrent radiotherapy treatment
    c. The indications for use of these agents in the neoadjuvant, adjuvant, and metastatic setting
14. **Surgical Oncology**
    a. The methods of obtaining histological diagnosis including core biopsy, excisional biopsy, and lymph node biopsy
    b. Surgical procedures including endoscopy, colonoscopy, esophagectomy including differences in surgical approach and its impact on radiotherapy, gastrectomy (subtotal/total) including options for anastomosis and reconstruction, endoscopic retrograde cholangiopancreatography (ERCP),

meso-rectal excision (MRE), defunctioning colostomy/ileostomy, abdominoperineal resection (APR), low anterior resection (LAR), and inguinal lymph node resection

15. **Radiotherapy Planning**

Treatment principles

a. Knowledge of standard dose/fractionation schedules
b. Early and late side effects Treatment planning
a. Immobilization methods and the importance of patient comfort and set-up reproducibility
b. Use of contrast agents for radiation planning
c. Identification of surgical scars, drain sites, and swellings, specifically identifying site of colostomy and anastomosis radiologically
d. Determination of GTV, CTV, and PTV
e. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
f. Tissue inhomogeneity corrections
g. Compensation for anatomical variations in the irradiated volume
h. Dosimetric planning including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
i. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
j. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with gastrointestinal cancer.*

- Gain expertise in obtaining a focused history and performing a reliable GI examination, particularly DRE. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of GI cancers.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of the radiation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for palliative, adjuvant, and radical radiation treatment of GI cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of the radiation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases.
- Be able to manage acute and late effects of GI radiotherapy.
- Have detailed knowledge of literature relevant to GI cancer treatment.

7.5.2.3 Genitourinary Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with genitourinary (GU) cancer. The GU oncology rotation will enable the radiation oncology

fellow to obtain the knowledge and skills necessary to diagnose and manage patients with GU cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the GU cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to GU oncology, with particular emphasis on prostate, bladder, testicular, and penile cancer. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**
   a. Risk factors for GU cancer such as smoking, ethnic background, family history, age, and cryptorchidism
   b. The incidence of GU tumors by sub-site
2. **Anatomy**
   a. Surface anatomy, draining lymphatics, blood supply, and nerve supply of the GU sub- sites
   b. The radiological anatomy of the pelvis using plain x-ray, CT scan, MRI, and PET scan
3. **Pathology**
   a. Benign and neoplastic lesions of the GU sub-sites
   b. The normal histology found in the genitourinary organs
   c. The process of carcinogenesis
   d. The classification of neoplastic disease arising from different anatomical GU sub-sites including epithelial and mesenchymal malignancies
   e. The importance of pathological prognostic factors, including histological differentiation, resection margins, the presence of perineural and lymphovascular invasion, the extent of disease burden in prostate cancer, and nodal involvement on the pathological report
   f. The principle of molecular pathology, including important growth factors receptors and different tumor markers
4. **Prevention**
   a. Indications of screening and identification of risk groups
   b. Screening methods: PSA or PSA derivatives, DRE in prostate cancer
   c. Risks and benefits of screening and impact on mortality
5. **Diagnostic Imaging**
   a. The use of different radiological modalities, particularly prostate US, CT scan, MRI, and PET scan with its different more specific radioisotopes needed for accurate staging of a patient with GU cancer
6. **Clinical Presentation**
   a. The natural history of each disease site
   b. The clinical presentation of local, regional, and metastatic disease
   c. The risk of nodal disease in relation to the anatomical site and stage of the disease

7. **Clinical Skills**
    a. A complete history and physical examination pertinent to a patient with GU cancer, particularly DRE in the assessment of prostate cancer, characterization, and quantification of urinary symptoms in prostate cancer
    b. Identification and management of treatment-related side effects of therapy, including skin reactions, weight loss, GI toxicities, rectal bleeding, sexual dysfunction, and hormonal toxicities
    c. Recognize and manage disease complications such as hematuria, obstructive uropathy, hypercalcemia, and marrow failure, as well as paraneoplastic conditions associated with renal and prostate cancer
8. **Staging**
    a. TNM categories and stage sub-grouping for GU cancer using the UICC system (8^{th} edition)
    b. Risk stratification in prostate cancer
    c. The principle of clinical, radiological, and pathological staging, as well as the restaging of recurrent disease
9. **Radiobiology**
    a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
    b. The principle of acute, early delayed, and delayed radiation reactions
    c. The concept of fractionation and its impact on both tumor control, and the normal tissue-induced toxicity for external beam therapy
    d. The normal and malignant tissue effects related to dose rate in brachytherapy
    e. The principle of radiation-induced malignancies
10. **Radiation Pathology**
    a. Radiation therapy-induced clinical and pathological changes in normal tissue, both at the histopathological and physiological levels
    b. The impact of other factors such as co-morbidities and/or systemic chemotherapy on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
11. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy including QA
    d. The physical properties of isotopes used in prostate brachytherapy, including radiation protection advantages and disadvantages of each
12. **Clinical Trials**
    a. The literature pertaining to GU oncology especially with randomized clinical trials (RTOG, EORTC, NCIC) that have impacted our current management in GU oncology
    b. Relevant clinical trials in their center

a. Investigational procedures such as cryotherapy and HIFU

13. **Medical Oncology**
    a. Systemic chemotherapy and targeted therapy in the context of GU oncology
    b. The array of chemotherapeutic, hormonal, and molecular agents used in the treatment of GU cancers, as well as the side effect profile of the various agents and the risks or benefits of concurrent radiotherapy treatment
    c. The indications for use of these agents in the neoadjuvant, adjuvant, and metastatic setting
14. **Surgical Oncology**

a. The methods of obtaining histological diagnosis including cytology, core biopsy, excisional biopsy, lymph node biopsy, particularly principles of systematic biopsy of the prostate
b. Surgical procedures including cystoscopy, TURP, radical prostatectomy, cystectomy with ileal conduit, nephrectomy, and orchiectomy

15. **Radiotherapy Planning**

Treatment principles

a. Knowledge of standard dose/fractionation schedules
b. Early and late side effects Treatment planning
a. Immobilization methods and the importance of patient comfort and set-up reproducibility
b. Identification of surgical scars, drain sites, and swellings
c. Determination of GTV, CTV, and PTV
d. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
e. Tissue inhomogeneity corrections
f. Compensation for anatomical variations in the irradiated volume
g. Dosimetric planning including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
h. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
i. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with genitourinary cancer.*

- Gain expertise in obtaining a focused history and performing a reliable GU examination, particularly DRE. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of GU cancers.
- Be able to outline treatment options and a treatment recommendation, describe the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for palliative, adjuvant, and radical radiation treatment of GU cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, describe the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases.
- Be able to manage acute and late effects of GU radiotherapy.
- Have detailed knowledge of literature relevant to GU cancer treatment.

7.5.2.4 Gynaecology Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with gynecologic cancer. The gynecology oncology rotation will enable the radiation oncology

fellow to obtain the knowledge and skills necessary to diagnose and manage patients with gynecologic cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the gynecology cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to gynecologic oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**
   a. Risk factors for gynecologic cancers such as HPV, obesity, diabetes, lifetime estrogen exposure and genetic factors (BRCA1, BRCA2)
   b. The incidence of gynecologic tumors, by sub-site
2. **Anatomy**
   a. Surface anatomy, draining lymphatics, blood supply, and nerve supply of all gynecologic sub-sites
   b. Age and pregnancy-related physiologic changes in the gynecologic tract
   c. Radiological anatomy of the gynecologic sites using plain x-ray, CT scan, MRI, and PET scan
3. **Pathology**
   a. Benign and neoplastic lesions of the gynecologic sub-sites
   b. Normal histology found in the gynecologic organs
   c. The process of carcinogenesis in all sub-sites, the molecular pathway to carcinogenesis in cervical cancer as a prototype for viral-induced cancers
   d. The classification of neoplastic disease arising from different anatomical sites in the gynecologic tract including epithelial and mesenchymal malignancies
   e. The importance of pathological prognostic factors, including histological differentiation, resection margins, depth of invasion, the presence of lymphovascular invasion and nodal involvement on the pathological report
   f. The principle of molecular pathology including important growth factors receptors and different tumor markers
4. **Prevention**
   a. Indications and frequency of cervical cytology
   b. Identification of risk groups
   c. Screening methods: PAP smear and ultrasound scan
   d. Risks and benefits of screening and impact on mortality
   e. Other preventive methods: HPV vaccination
5. **Diagnostic Imaging**
   a. The use of different radiological modalities, particularly CT scan, MRI, and PET scan needed for accurate staging of a patient with gynecologic cancer
6. **Clinical Presentation**

a. The natural history of each disease site and the clinical presentation of local, regional, and metastatic disease
b. The risk of nodal disease in relation to the anatomical site and stage of the disease

7. **Clinical Skills**
   a. A complete history and physical examination including examination under anesthesia (EUA), pertinent to a patient with gynecologic cancer, recognizing and describing abnormal findings
   b. Identification and management of treatment-related side effects of therapy, including skin reactions, weight loss, GI toxicities, and menopausal symptoms
   c. Management of disease complications such as hemorrhage, ureteric obstruction, and ascites
   d. Insertion of brachytherapy applicator for cervical cancer and endometrial cancer
8. **Staging**
   a. Particularly FIGO but also TNM categories and stage sub-grouping for gynecologic cancers using the UICC system (8th edition)
   b. The principle of clinical, radiological, and pathological staging, as well as the restaging of recurrent disease
9. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
   c. The concept of fractionation and its impact on both tumor control and normal tissue- induced toxicity; such fractionation schedules include hyperfractionation, accelerated fractionation, concomitant boost, and hypofractionation
   d. The normal and malignant tissue effects related to dose rate in brachytherapy
10. **Radiation Pathology**
    a. Radiation therapy-induced clinical and pathological changes in normal tissue, both at the histopathological and physiological levels
    b. The impact of other factors such as co-morbidities and/or systemic chemotherapy on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
11. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy including QA
    d. The physical properties of isotopes used in gynecologic brachytherapy, including radiation protection advantages and the disadvantages of each
12. **Clinical Trials**
    a. The literature pertaining to gynecologic oncology especially with randomized clinical trials (GOG, EORTC, NCIC) that have impacted our current management in gynecology oncology
    b. Relevant clinical trials in their center
13. **Medical Oncology**
    a. Systemic chemotherapy and targeted therapy in the context of gynecologic oncology
    b. The principles of concomitant, induction, and adjuvant chemotherapy sequences with radiotherapy
14. **Surgical Oncology**
    a. The methods of obtaining histological diagnosis such as Pap smear, punch biopsy, cone biopsy, pipelle sampling, and fractional D & C

b. The principles of surgical management in gynecologic cancer including radical hysterectomy, total abdominal hysterectomy and bilateral salpingo-oopherectomy (TAH & BSO), radical vulvectomy, pelvic lymph node and also inguinal node dissection, and ovarian surgery including debulking

15. **Radiotherapy Planning**

Treatment principles

a. Knowledge of standard dose/fractionation schedules
b. Early and late side effects Treatment planning
a. Immobilization methods and the importance of patient comfort and set-up reproducibility
b. Identification of surgical scars, drain sites, and swellings
c. Determination of GTV, CTV, and PTV
d. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
e. Tissue inhomogeneity corrections
f. Compensation for anatomical variations in the irradiated volume
g. Dosimetric planning, including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
h. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
i. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors, and treatment factors) in a patient presenting with gynecologic cancer.*

- Gain expertise in obtaining a focused history and performing a reliable gynecologic examination. Be able to perform a Pap smear. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of all gynecologic cancer sub-sites.
- Be able to outline treatment options and a treatment recommendation, describe the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for palliative, adjuvant, and radical radiation treatment of gynecologic cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, describe the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases.
- Be able to manage acute and late effects of pelvic radiation.
- Have detailed knowledge of literature relevant to gynecologic cancer treatment.
- Be able to discuss current recommendations regarding screening and vaccination for cervical cancer.

7.5.2.5 Head and Neck Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with head and neck cancer. The head and neck oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with head and neck cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the head and neck cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to head and neck oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**
   a. Risk factors for head and neck cancer such as smoking, alcohol, viral (EBV and HPV), and immune deficiency
   b. The relative incidence of the common types of benign and malignant head and neck tumors
2. **Anatomy**
   a. Surface anatomy, draining lymphatics, blood supply, and nerve supply of all head and neck anatomical sites
   b. The radiological anatomy of the head and neck and base of skull using plain x-ray, ultrasound, CT scan, MRI, and PET scan
3. **Pathology**
   a. Benign and neoplastic lesions of the head and neck
   b. The normal histology found in the different head and neck organs
   c. The process of carcinogenesis
   d. The classification of neoplastic disease arising from different anatomical sites in the head and neck, including epithelial and mesenchymal malignancies
   e. The importance of pathological prognostic factors, including histological differentiation, resection margins, the presence of perineural and lymphovascular invasion, and extracapsular extension on the pathological report
   f. The methods used for tissue diagnosis such as FNA, core biopsy, excision biopsy, and lymph node biopsy
   g. The principle of molecular pathology, including important growth factors receptors and different tumor markers, especially in thyroid malignancy
4. **Diagnostic Imaging**
   a. The radiological anatomy of the head and neck using different radiological modalities, particularly CT scan, MRI, and PET scan
5. **Clinical Presentation**
   a. The natural history of each disease site
   b. The clinical presentation of local, regional, and metastatic disease

c. The risk of nodal disease in relation to the anatomical site and stage of the disease

6. **Clinical Skills**
   a. A complete history and physical examination including flexible endoscopy and CNS examination
   b. Identification and management of treatment-related side effects of therapy, including mucositis, skin reactions, xerostomia, loss of taste, weight loss, febrile neutropenia, thrombocytopenia, electrolytes and water balance, as well as the different paraneoplastic syndromes associated with head and neck cancer
7. **Staging**
   a. TNM categories and stage sub-grouping for head and neck cancer using the UICC system (8th edition)
   b. The principle of clinical, radiological and pathological staging, as well as the restaging of recurrent disease
8. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
   c. The concept of fractionation and its impact on both tumor control, as well as the normal tissue-induced toxicity; such fractionation schedules include hyperfractionation, accelerated fractionation, concomitant boost, and hypofractionation
   d. The principle of radiation-induced malignancies
9. **Radiation Pathology**
   a. Radiation-induced clinical and pathological changes in normal tissue, both at the histopathological and physiological levels
   b. The impact of other factors such as co-morbidities and systemic chemotherapy on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
10. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy including QA
    d. Physical properties of other modalities such as proton, neutrons, and heavy ions as appropriate for the treatment of head and neck and base of skull tumors
    e. The principles of stereotactic radiosurgery, and TomoTherapy and Cyberknife techniques appropriate to each anatomical site and stage of disease
11. **Clinical Trials**
    a. The literature pertaining to head and neck oncology especially with randomized clinical trials (RTOG, DAHANCA, EORTC, NCIC) that have impacted our current management in head and neck oncology
    b. Relevant clinical trials in their center
12. **Medical Oncology**
    a. Systemic chemotherapy and targeted therapy in the context of head and neck oncology
    b. The principles of concomitant, induction, and adjuvant chemotherapy sequences with radiotherapy
13. **Surgical Oncology**
    a. The principles of surgical management in head and neck cancer

b. Surgical procedures include total laryngectomy, thyroidectomy, lymph node neck dissection, laser excision and reconstructive procedures, including myocutaneous and vascularized graft

14. **Radiotherapy Planning**

Treatment principles

a. Knowledge of standard dose/fractionation schedules
b. Early and late side effects Treatment planning
a. Immobilization methods and the importance of patient comfort and set-up reproducibility
b. Identification of surgical scars, drain sites, and swellings
c. Determination of GTV, CTV, and PTV
d. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
e. Tissue inhomogeneity corrections
f. Compensation for anatomical variations in the irradiated volume
g. Dosimetric planning, including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
h. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
i. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility:**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with head and neck cancer.*

- Gain expertise in obtaining a focused history and performing a reliable head and neck examination, including flexible endoscopy. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of head and neck cancers.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for adjuvant and radical radiation treatment of head and neck cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases, particularly patients presenting with recurrent head and neck cancer.
- Be able to manage acute and late effects of head and neck radiation.
- Have detailed knowledge of literature relevant to head and neck cancer treatment.

7.5.2.6 Thoracic Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with lung cancer. The thoracic oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with lung cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the lung cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to thoracic oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**
   a. Risk factors for lung cancer such as smoking, and occupational and environmental exposures
   b. The incidence of the various lung cancer sub-types
2. **Anatomy**
   a. Surface anatomy, draining lymphatics, blood supply, and nerve supply of the lungs
   b. Functional anatomy of the lung as described by pulmonary function tests
3. **Pathology**
   a. Benign and neoplastic lesions of the lungs
   b. Normal histology of the lungs
   c. The process of carcinogenesis
   d. The classification of neoplastic disease arising from different anatomical sites in the lungs and pleura including epithelial and mesenchymal malignancies
   e. The importance of pathological prognostic factors, including histological differentiation, resection margins, the presence of perineural and lymphovascular invasion and nodal involvement on the pathological report
   f. The principle of molecular pathology including important growth factors receptors and different tumor markers
4. **Diagnostic Imaging**
   a. The use of different radiological modalities, particularly endoscopic US, CT scan, MRI, and PET scans needed for the accurate staging of a patient with lung cancer
5. **Clinical Presentation**
   a. The natural history of each disease site
   b. The clinical presentation of local, regional, and metastatic disease
   c. The risk of nodal disease in relation to the anatomical site and stage of the disease
6. **Clinical Skills**
   a. A complete history and physical examination pertinent to a patient with lung cancer
   b. The indications for use of a Pleural catheter for symptom management
   c. Identification and management of treatment-related side effects of therapy, including skin reactions, weight loss, dysphagia, dyspnea and cough, febrile neutropenia, thrombocytopenia, electrolytes and water balance, as well as the different paraneoplastic syndromes associated with lung cancer
7. **Staging**
   a. TNM categories and stage sub-grouping for lung cancer using the UICC system (8th edition)

b. The principle of clinical, radiological, and pathological staging, as well as the restaging of recurrent disease

8. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
   c. The concept of fractionation and its impact on both tumor control, as well as the normal tissue-induced toxicity; such fractionation schedules include hyperfractionation, accelerated fractionation, concomitant boost, and hypofractionation
   d. The principle of radiation-induced malignancies
9. **Radiation Pathology**
   a. Radiation-induced, clinical, and pathological changes in normal tissue, both at the histopathological and physiological levels
   b. The impact of other factors such as co-morbidities and systemic chemotherapy on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
10. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy, including QA
    d. The principles of extracranial stereotactic radiosurgery and TomoTherapy
11. **Clinical Trials**
    a. The literature pertaining to lung oncology especially with randomized clinical trials (RTOG, EORTC, NCIC) that have impacted our current management in lung oncology
    b. Relevant clinical trials in their center
12. **Medical Oncology**
    a. Systemic chemotherapy and targeted therapy in the context of lung oncology
    b. The principles of concomitant, induction, and adjuvant chemotherapy sequences with radiotherapy
13. **Surgical Oncology**
    a. The methods used for tissue diagnosis such as sputum cytology, FNA, core biopsy, excisional biopsy, and lymph node biopsy
    b. The methods of obtaining histological diagnosis, including thoracentesis, bronchoscopy, and mediastinoscopy
    c. The principles of surgical procedures including lobectomy, intraoperative lymph node biopsy, and pneumonectomy
14. **Radiotherapy Planning**

Treatment principles

   i. Knowledge of standard dose/fractionation schedules
   ii. Early and late side effects Treatment planning
   i. Immobilization methods and the importance of patient comfort and set-up reproducibility
   ii. Use of 4D-CT and respiratory gating
   iii. Identification of surgical scars, drain sites, and swellings
   iv. Determination of GTV, CTV, and PTV
   v. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan

vi. Tissue inhomogeneity corrections
vii. Compensation for anatomical variations in the irradiated volume
viii. Dosimetric planning, including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
ix. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
x. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with lung cancer.*

- Gain expertise in obtaining a focused history and performing a reliable chest examination. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of lung cancers.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for palliative, adjuvant, and radical radiation treatment of lung cancer.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, discuss the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases.
- Be able to manage acute and late effects of chest radiation.
- Have detailed knowledge of literature relevant to lung cancer treatment.

7.5.2.7 Haematology Oncology

Radiation treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with hematologic cancer. The hematology oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with hematologic cancer in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the hematology cancer service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to hematology oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**

a. Risk factors for hematologic cancer such as family history, genetic abnormalities, infectious agents (HIV, EBV, Helicobacter pylori) and prior radiation exposure
b. The principle of malignant transformation in hematologic malignancy
c. The incidence of the common hematologic malignancies

2. **Anatomy**
   a. Of the lymphoreticular system, including bone marrow and spleen
   b. The microarchitecture as well as the functional anatomy of the lymphoreticular system
3. **Pathology**
   a. Benign and neoplastic diseases of the lymphoreticular system
   b. Normal hematopoiesis
   c. The process of carcinogenesis
   d. The classification of neoplastic disease arising in the lymphoreticular system using the WHO classification system
   e. The importance of pathological prognostic factors, in particular, molecular and genetic factors
   f. The special methods of a lymphoma protocol used for tissue diagnosis including immunohistochemical stains, flow cytometry, and PCR
   g. Evaluation of bone marrow biopsy and aspirate
4. **Diagnostic Imaging**
   a. Indications for and interpretation of CT and PET in staging, restaging, and follow-up
   b. The sensitivity and specificity of these imaging modalities
5. **Clinical Presentation**
   a. The natural history of hematologic malignancies, in particular, lymphoma and plasma cell disorders
   b. The presentation of nodal (both Hodgkin and non-Hodgkin) lymphoma as well as extra- nodal lymphomas such as CNS, GI tract, testis, and skin
6. **Clinical Skills**
   a. A complete history and physical examination relevant to the lymphoreticular system, including assessment of all nodal areas as well as spleen and skin, recognizing and describing abnormal findings
   b. Recognize and manage treatment-related toxicities, in particular, febrile neutropenia
7. **Staging**
   a. Ann Arbor staging with Cotswold modifications
   b. Risk stratification systems: international prognostic index (IPI) and follicular lymphoma interntional prognostic Index (FLIPI)
   c. The principle of clinical, radiologic, and pathological staging, as well as the restaging of recurrent disease
8. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
   c. The concept of fractionation and its impact on both tumor control, as well as the normal tissue-induced toxicity
   d. The principle of radiation-induced malignancies
9. **Radiation Pathology**

a. Radiation therapy-induced clinical and pathological changes in normal lymphoreticular tissue, both at the histopathological and physiological levels
b. The impact of other factors such as co-morbidities and/or systemic chemotherapy on the incidence and severity of radiation-induced pathological changes in the irradiated tissues

10. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy, including QA
    d. Principles of total body irradiation and total skin irradiation
    e. Principles of brachytherapy using unsealed sources as well as related radiation safety issues
11. **Clinical Trials**
    a. The literature pertaining to hematologic oncology especially randomized clinical trials (NCI, CALGB, GELA, German Hodgkin Study Group) that have impacted our current management in hematologic oncology
    b. Relevant clinical trials in their center
12. **Medical Oncology**
    a. The array of chemotherapeutic and molecular agents used in the treatment of hematologic cancer, as well as the side effect profile of the various agents and the risks or benefits of concurrent radiotherapy treatment
    b. The indications for use of these agents in the neoadjuvant, adjuvant, and metastatic setting
    c. The indications for bone marrow or stem cell transplant and understand when allo- vs. auto-transplant is indicated
13. **Radiotherapy Planning**
    a. Treatment principles
        i. Knowledge of standard dose/fractionation schedules
        ii. Early and late side effects
    b. Treatment planning
        i. Immobilization methods and the importance of patient comfort and set-up reproducibility
        ii. Identification of surgical scars, drain sites, and swellings
        iii. Determination of GTV, CTV, and PTV
        iv. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
        v. Tissue inhomogeneity corrections
        vi. Compensation for anatomical variations in the irradiated volume
        vii. Dosimetric planning including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
        viii. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy of unsealed sources
        ix. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with hematologic cancer.*

- Gain expertise in obtaining a focused history and performing a reliable examination of the lymphoreticular system. Be able to present findings of the history and exam.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of hematologic cancer.
- Be able to outline treatment options and a treatment recommendation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for treatment of hematologic malignancy.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on a thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases, particularly involving re-irradiation.
- Be able to manage acute and late effects of radiation for hematologic cancer.
- Have detailed knowledge of literature relevant to hematology oncology treatment.

7.5.2.8 Medical Oncology

Systemic treatment plays an important role in the curative, adjuvant, and palliative treatment of patients with cancer. The medical oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to understand and utilize systemic therapy in the management of cancer patients in a multidisciplinary team environment.

- **Medical Expert**

The fellow will possess a body of knowledge and management skills relevant to medical oncology. This will enable the fellow to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be able to:

- Elicit a focused and accurate history and physical exam relevant to a particular tumor site (breast, lung, GU, GI, hematologic, CNS, H & N, skin, and musculoskeletal), recognizing and describing abnormal findings.
- Order appropriate staging investigations for a new or relapsed malignancy, and be able to interpret the results.
- Know the classification of chemotherapeutic agents, targeted/molecular agents, hormonal agents, and bisphosphonates; which drugs are commonly used for specific cancers, usual frequency of administration, typical doses and adverse effects, the principles of titration, the routes of administration, the effects of renal and liver dysfunction on chemotherapeutic drugs.
- Recognize and manage common complications of cancers and their treatment in the curative and palliative settings, such as venous thrombosis, pneumonia, nausea and vomiting, pan-mucositis, febrile neutropenia, pericardial tamponade, SVC obstruction, cord compression, hypercalcemia, and hyponatremia.
- Recognize and manage common complications of treatment with chemotherapy, particularly febrile neutropenia, GI toxicities, and allergic drug reactions.

- Understand the principles of medical oncology treatment decision-making, including consideration of benefits and risks of different drugs for cancer management and evaluation of response.
- Understand the process of director's privileges and special access for non-formulary agents.
- Learn to perform the following procedures:
  a. Paracentesis
  b. Lumbar puncture
  c. Thoracentesis

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting to the medical oncology service.*

- Gain expertise in obtaining a focused history and performing a reliable physical examination. Be able to present findings of the history and exam.
- Learn about standard regimens for adjuvant systemic therapy in breast, lung, GI, H & N, and CNS cancers. Be able to outline treatment options and a treatment recommendation for these tumor sites.
- Be able to manage common chemotherapy toxicities (febrile neutropenia, GI toxicities, and allergic reactions).

Senior fellows: *Focus on interpreting and synthesizing basic principles based on critical appraisal of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Learn about systemic therapy regimens used in the curative and metastatic setting for hematologic malignancies.
- Learn about systemic therapy regimens used in the metastatic setting of breast, lung, GI, GU, H & N, and skin cancers.

7.5.2.9 Skin and Soft Tissue Tumours

Radiation treatment plays an important role in the adjuvant, and palliative treatment of patients with skin cancer and sarcoma. The skin cancer and sarcoma oncology rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with mesenchymal tumors in a multidisciplinary team environment.

At the completion of training, the trainee will have demonstrated the necessary knowledge and skills to function effectively as a consultant on the sarcoma service, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills relevant to mesenchymal tumors, with particular emphasis on soft tissue sarcoma and retroperitoneal sarcomas. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be familiar with:

1. **Epidemiology**

a. Risk factors for soft tissue sarcoma such as radiation exposure, and hereditary conditions
b. The incidence of soft tissue sarcomas

2. **Anatomy**
   a. Surface anatomy, draining lymphatics, blood supply, and nerve supply of extremities
   b. The radiological anatomy of the extremities using plain x-ray, CT scan, MRI, and PET scan
3. **Pathology**
   a. The WHO classification of neoplastic disease of mesenchymal malignancies
   b. The importance of pathological prognostic factors, including histological differentiation, resection margins, the presence of perineural and lymphovascular invasion, and nodal involvement on the pathological report
   c. The principle of molecular pathology including important growth factors receptors and different tumor markers
4. **Diagnostic Imaging**
   a. The use of different radiological modalities, particularly, CT scan, and MRI needed for accurate staging of a patient with extremity sarcomas
5. **Clinical Presentation**
   a. The natural history
   b. The clinical presentation of local, regional, and metastatic disease
   c. The risk of nodal disease in relation to the histology, anatomical site, and stage of the disease
6. **Clinical Skills**
   a. A complete history and physical examination pertinent to a patient with sarcoma
   b. Identification and management of treatment-related side effects of therapy, including skin reactions, sexual, functional impairment
   c. Recognize and manage disease complications such as neurovascular involvement
7. **Staging**
   a. TNM categories and stage grouping for sarcomas (8th edition)
   b. The principle of clinical, radiological, and pathological staging, as well as the restaging of recurrent disease
8. **Radiobiology**
   a. The effect of x-rays on the normal and neoplastic tissues in the irradiated volumes
   b. The principle of acute, early delayed, and delayed radiation reactions
9. **Radiation Pathology**
   a. Radiation therapy-induced clinical and pathological changes in normal tissue, both at the histopathological and physiological levels
   b. The impact of other factors such as co-morbidities and/or systemic chemotherapy on the incidence and severity of the radiation-induced pathological changes in the irradiated organs
10. **Radiation Physics**
    a. Properties of photons and electrons
    b. Principles of radiation safety relevant to linear accelerators and brachytherapy
    c. Principles of intensity-modulated radiotherapy, including QA
    d. The physical properties of isotopes used in prostate brachytherapy, including the radiation protection advantages and disadvantages of each
11. **Clinical Trials**

a. The literature pertaining to soft tissue sarcomas especially with randomized clinical trials (RTOG, NCI) that have impacted our current management in soft tissue sarcomas
b. Relevant clinical trials in their center

12. **Medical Oncology**
    a. Systemic chemotherapy and targeted therapy in the context of soft tissue sarcomas
    b. The array of chemotherapeutic and molecular agents used in the treatment of sarcomas, as well as the side effect profile of the various agents and the risks or benefits of concurrent radiotherapy treatment
    c. The indications for use of these agents in the adjuvant and metastatic setting
13. **Surgical Oncology**
    a. The methods of obtaining histological diagnosis including core biopsy, incisional biopsy
    b. Surgical procedures, including amputation vs. limb-sparing, wide local excision, radical excision
14. **Radiotherapy Planning**

Treatment principles

a. Knowledge of standard dose/fractionation schedules
b. Early and late side effects Treatment planning
a. Immobilization methods and the importance of patient comfort and set-up reproducibility
b. Identification of surgical scars, drain sites, and swellings
c. Determination of GTV, CTV, and PTV
d. Dose-volume constraints for neoplastic and normal tissues relevant to the fractionation schedule proposed for the plan
e. Tissue inhomogeneity corrections
f. Compensation for anatomical variations in the irradiated volume
g. Dosimetric planning including use of bolus, choice of photon and/or electron energies, beam weighting, and use of wedges
h. The ICRU recommendations for dose prescriptions for external beam therapy and brachytherapy
i. Verification of treatment delivery, including patient set-up and imaging

- **Graded Responsibility**

Junior fellows: *Focus on assessment and reporting of basic principles (patient factors, tumor factors and treatment factors) in a patient presenting with skin and soft tissue sarcomas*

- Gain expertise in obtaining a focused history and performing a reliable examination.
- Learn the epidemiology, anatomy, pathology, diagnostic imaging, clinical presentation, and staging of extremity sarcomas.
- Be able to outline treatment options and a treatment recommendation, describe the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff for palliative, adjuvant, and radical radiation treatment of extremity sarcomas.

Senior fellows: *Focus on interpreting and synthesizing basic principles based on thorough understanding of published literature as well as accumulated clinical experience.*

- Build on the knowledge and skills acquired as a junior fellow.
- Be able to outline treatment options and a treatment recommendation, describe the role and benefits of radiation therapy, obtain informed consent, and work with radiotherapy planning and treatment delivery staff on complex cases.

- Be able to manage acute and late effects of extremity sarcomas.
- Have detailed knowledge of literature relevant to extremity sarcoma treatment.

7.5.2.10 Palliative Medicine

The objectives for the palliative medicine rotation are based on principles common to palliative care and oncology. The palliative medicine rotation will enable the radiation oncology fellow to obtain the knowledge and skills necessary to diagnose and manage patients with advanced cancer in a multidisciplinary team environment.

At the completion of training, the fellow will have demonstrated the necessary knowledge and skills to provide palliative care as part of a radiation oncology consultant practice, integrating all the CanMEDS competencies in order to provide optimal, ethical, and patient-centered medical care.

- **Medical Expert**

The fellow will possess a body of knowledge and management skills relevant to palliative care. This will enable the fellow to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

Basic and Clinical Knowledge

1. **Physical Aspects**
   a. Disease process: The fellow should know the meaning of "terminal illness" and of "palliative medicine''; understand the concept of clinical re-evaluation as the disease progresses; be able to anticipate potential problems caused either by the disease or by treatments; have skills in diagnosis and management of common concurrent conditions; know the natural history, markers of progression, and range of treatments available at each stage of malignant diseases.
   b. Symptom control: The fellow should know that symptoms may be caused by the disease itself, caused by treatment, related to disease or associated disability, or caused by a pre-existing or concurrent disorder. The fellow should be able to direct management of each symptom appropriately. This includes candidiasis, anorexia, nausea and vomiting, constipation, diarrhea, intestinal obstruction, dysphagia, pruritis, jaundice, dyspnea, cough, hiccups, anxiety and fear and their role in intensifying symptoms, depression (situational vs. clinical), delirium, fatigue, sexual dysfunction, incontinence, bladder and rectal spasms, and lymphedema.
   c. Pain: The fellow should be able to take a pain history, including the use of assessment tools such as Edmonton Symptom Assessment Score (ESAS), Brief Pain Inventory, and EORTC QLQ C30. Be able to differentiate between nociceptive and neuropathic pain. Elicit factors influencing pain (physical, psychological, social, and spiritual). Assess opioid responsiveness and appropriate use of co-analgesics. Recognize when appropriate referral to radiation oncology or anesthesia is indicated. Be aware of non-drug treatments and complementary/alternative therapies.
   d. Management of emergencies: The fellow should be able to identify and direct management of common emergencies such as hypercalcemia, spinal cord compression, superior vena cava obstruction, hemorrhage, and seizures.
   e. Management of sub-acute issues: The fellow should be able to direct management of fungating lesions and wound care, pressure area care, raised intracranial pressure, fistulae, and malignant effusions.

2. **Pharmacology**

The fellow should know the classification of analgesics (as defined by the World Health Organization) and their use; which drugs are commonly used for the control of symptoms, usual frequency of administration, typical doses and adverse effects, and the principles of titration; the pharmacological management of difficult pain syndromes such as incident pain, and neuropathic pain; the various routes available for drug administration and when each is appropriate; the effects of renal and liver failure on drugs commonly used in palliative medicine; how to weigh up benefits and risks of different drugs for symptom control, being aware that these may change as a patient condition deteriorates; the rationale for, and clinical practice of opioid switching.

3. **Psychosocial Aspects**

The fellow should be able to assess the differing perceptions and expectations of disease and treatment among the various family members; understand the importance of meetings with the family; be aware of the psychodynamics of interpersonal relationships and the changes which can occur in illness; assess the need for bereavement support and know how to refer to other disciplines for assistance in supporting a bereaved person.

4. **Organizational Aspects**

The fellow should know about statutory regulation such as certification of death and controlled drugs regulations.

7.5.3 NON-CORE ROTATIONS

Competencies for the CanMEDS role as a Medical Expert will be described below specifically for each rotation. Competencies in other CanMEDS roles of universal topics are summarized as follows:

- **Communicator**

The fellow will:

1. Provide a verbal and written summary of the patient's medical problems, and keep legible and accurate records of in-patient as well as outpatient care
2. Effectively relay patient problems and work out possible solutions with other members of the health care team
3. Clearly, consistently, and accurately communicate the patient diagnosis, management plan, risks and benefits of any treatment, and prognosis with the patient, relevant family members, and decision makers
4. Obtain informed consent for procedures as required

- **Collaborator**

The fellow will:

1. Describe their role and function within a multidisciplinary team approach to healthcare
2. Understand the role of other specialties in the multidisciplinary approach to patient management
3. Have a straightforward approach with staff and peers
4. Assist others as required
5. Take on an appropriate share of team assignments
6. Consult effectively with other healthcare professionals
7. Contribute effectively to interdisciplinary team activities

- **Manager**

The fellow will:

1. Allocate health care resources wisely and order medical tests with a view toward maximizing utility while minimizing cost
2. Make effective use of information technology to optimize patient care
3. Demonstrate effective time management and organizational skills

- **Health Advocate**

The fellow will:

1. Function as an advocate for their patient to obtain adequate care corresponding to the priority of their conditions
2. Provide information on prevention programs for various cancers and intervention programs for smoking cessation or other addictions issues

- **Scholar**

The fellow will:

1. Accept the responsibility for self-directed learning as a lifelong goal
2. Formulate educational questions resulting from their patient-related responsibilities
3. Complete a literature search based on specific educational questions
4. Explain the principles of critical appraisal and its relevance to clinical decision-making
5. Attend and contribute to rounds, seminars, and other learning events
6. Accept and act on constructive feedback
7. Record personal learning objectives during the rotation and take responsibility for self- managing their own learning objectives documented at the beginning of the rotation

- **Professional**

The fellow will:

1. Recognize limitations and seek advice and consultation when needed
2. Exercise initiative within limits of knowledge and training
3. Discharge duties and assignments dependably and in a timely and ethical manner
4. Report facts accurately, including own errors
5. Maintain appropriate boundaries in work and learning situations
6. Respects the diversity of race, age, gender, disability, intelligence, and socio-economic status
7. Demonstrate an understanding of the basic principles of medical ethics, including patient autonomy, beneficence, confidentiality, conflict of interest, and advance directives
8. Recognize own limitations and seek advice when necessary
9. Provide feedback respectfully and accept feedback from colleagues and peers

7.5.3.1 Haematology Oncology

Objectives for Radiation Oncology Fellow for Competency in CanMEDS Roles in Hematology

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills in hematology relevant to a primary clinician and to oncology. This will enable the trainee to collect and to interpret data, and to carry out diagnostic and therapeutic procedures within the limits of their expertise.

The fellow will be able to:

1. Demonstrate a basic understanding of the WHO classification of malignant tumors of the hematologic system and the IPI scoring scheme of non-Hodgkin lymphoma.
2. Choose appropriate staging investigations for a new diagnosis or relapsed hematologic malignancy.
3. Demonstrate a basic understanding of the indications for bone marrow or stem cell transplant and understand when allo- vs. auto-transplant is indicated.
4. Describe the technique of bone marrow aspirate and biopsy as well as the type of information obtained from each of the two samples.
5. Understand the pharmacology of agents used in the treatment of hematologic cancers.

The fellow will be able to **diagnose and manage** common problems experienced by the general medical patient and in a patient with a hematologic malignancy; these include, but are not exclusive to the following:

1. Common complications of hematologic cancers such as:
   a. Pain
   b. Febrile neutropenia
   c. Pericardial tamponade
   d. Superior vena cava obstruction
   e. Cord compression
2. Common benign hematologic disorders such as:
   a. Immune thrombocytopenic purpura Thrombotic thrombocytopenic purpura Disseminated intravascular coagulation

The fellow will display effective **clinical skills** in the following:

1. Elicit a focused and accurate history relevant to the hematologic system. This includes symptoms of hematologic pathology and should include a review of performance status, history of fever and/or sweats, medications, travel history, occupational exposures, family history, and social history (specifically HIV risk).
2. Accurately perform a physical exam relevant to the hematologic system. This includes assessment of regional nodes, liver and spleen, and skin.
3. Learn how to present a case in a clear, concise, integrated, and problem-based manner.
4. Record in the medical record accurate, problem-oriented progress notes, and brief and informative discharge summaries.
5. Order pertinent laboratory and other investigations, justifies their use, interpret and integrate the information appropriately.
6. Demonstrate a systematic approach to clinical problem-solving and implement a management plan with clear, comprehensive, and correct orders.

The fellow will display an understanding of **technical skills** in the following:

1. Bone marrow aspirate and biopsy

7.5.3.2 Pathology

Objectives for Radiation Oncology Fellow for Competency in CanMEDS Roles in Pathology

- **Medical Expert**

The trainee will possess a body of knowledge and technical skills in pathology relevant to a radiation oncology fellow.

The fellow will be able to:

1. Describe what is involved in the following procedures.
   a. Gross examination of surgical specimens
   b. Cytological Examination of needle aspirates
   c. Fixation and paraffin embedding of slides
   d. Frozen Section
   e. Cytology of pleural fluid
2. Describe the indications, applications and limitations of fine needle aspiration and needle biopsy
3. Identify the gross features of common cancers
4. Identify the general pathological features of hyperplasia, metaplasia, dysplasia, neoplasms, in situ carcinoma, and frank carcinoma
5. Demonstrate knowledge of the common histological features of cancers of the colon and rectum, lung, breast, skin, thyroid, esophagus, stomach, ovary, anus, urinary bladder, and prostate
6. Be able to provide a classification for tumors of the skin, lung, head and neck, thyroid, breast, kidneys, esophagus, stomach, colon and rectum, testicle, anus, urinary bladder, ovary, and lymphatic system
7. Be able to describe the histological features of radiation change in normal tissues

7.5.3.3 Radiology and Nuclear Medicine

Objectives for Radiation Oncology Fellow for Competency in CanMEDS Roles in Radiology and Nuclear Medicine

- **Medical Expert**

As a clinical specialist devoted to management of cancer patients, the radiation oncologist uses all aspects of imaging and, especially, tumor imaging. In addition, he/she will use specialized techniques of tumor imaging in the precise planning of radiation treatment. The general objectives of this rotation in DIAGNOSTIC RADIOLOGY are to give to the radiation oncology fellow the necessary body of knowledge in diagnostic radiology that will allow him or her to fulfill the role adequately.

1. CT scanning:
   a. The trainee will be able to briefly describe the physical principles of CT Scanning. He or she will be able to describe the rationale behind the use of contrast agents and to discuss the main indications for their use in tumor imaging.
   b. The trainee will be able to recognize on CT scans, the gross normal anatomy of the brain, the chest and mediastinum, and the abdomen and pelvis. He or she will be able to recognize and describe the modification of normal anatomy related to tumors in these different sites.

2. Magnetic resonance imaging (MRI):
    a. The trainee will be able to describe briefly the physical principles of MR imaging and to describe the different parameters that can be varied in the production of MR scans as well as the general effect of these variations. He or she will be able to name the principal contrast agents used and to recognize and describe the changes caused by these contrast materials.
    b. The trainee will be able to recognize on MRI scans the normal anatomy of the brain, the head and neck region, the cord, the thorax, the abdomen and pelvis, and will be able to recognize and describe the main MRI changes caused in these organs by tumors.
    c. The trainee will be able to compare the relative advantages of MRI over other imaging modalities and, especially, CT Scanning for the main tumors.
3. Nuclear medicine objectives:
    a. The trainee will become familiar with scientific principles, technology, and clinical applications of nuclear medicine studies as they pertain to the practice of oncology.
    b. The trainee will obtain an understanding of the physical and biological properties of radiopharmaceuticals used in the diagnosis and treatment of cancer.
    c. The trainee will develop knowledge of radiation safety procedures.
    d. The trainee will become familiar with the clinical indications and usefulness of the different nuclear medicine examinations.
    e. The trainee will develop knowledge of the advantages and disadvantages of the different examinations in relationship to other radiologic imaging modalities.
    f. The trainee will become familiar with the following techniques:
        - Bone scanning, three Part studies, spot views, whole body imaging, quantitative assessment, and SPECT
        - PET (positron emission tomography in oncology)
        - Thyroid uptake determination and imaging with 99mTc, 123I, and/or 131I
        - 131I body scanning

8 ASSESSMENT OF FELLOW

8.1 Purpose of Assessment

- Enhance learning by providing formative assessments, enabling trainees to receive immediate feedback, measure their own performance, and identify areas for development.
- Drive learning and enhance the training process by clarifying what is required of trainees and motivating them to ensure they receive suitable training and experience.
- Provide robust, summative evidence that trainees are meeting the curriculum standards during the training program.
- Ensure trainees are acquiring competencies within the domains of good medical practice.
- Ensure that trainees possess the essential underlying knowledge, skills, and attitudes required for their specialty.
- Identify trainees who should be advised to consider a career change.

8.2 Assessment Methods

Fellows will undergo two major sets of examinations, namely Part I, and Part II of the F Rad Onc examination. This will be coupled with ongoing continuous assessment by their supervisors and an annual review by the programme director or head of the department. Progression to the next level of training is NOT automatic and is dependent on the Fellow satisfying all the competency requirements of each defined level as per this curriculum and learning guide. The assessment framework is designed to provide a coherent system of assessing both formative and summative assessment which are workplace-based and in examination settings.

The continuous assessments and final annual assessments are weighted at 40% and 60% of the final mark of Annual Review of Competence Progression, respectively. Assessment methods may include, but are not limited to, the following:

- Log of experiences and procedures completed,
- case reports,
- portfolios,
- Research Assignment
- Structured examinations including multiple choice questions, short answer questions, modified essay questions, short and long cases, objective structured clinical examinations (OSCE), and Viva Voce, etc.

It is emphasized that marks from theory examinations **may not** compensate for poor scores in the clinical examinations; Students **MUST** pass the clinical examinations in order to progress to the next stage of training or completion.

A candidate shall be allowed a maximum of three attempts for Part I and/or Part II examinations. Candidates must have submitted a completed log book to eligible to attempt the Part II examination.

For admission to Part II examination a candidate must have:

- Have successfully completed Part I examinations

- Produce evidence of having completed three years instruction and training in fulltime posts in a recognised department of radiation therapy
- Provide a list of required case reports (30)
- Oncology article for statistical review (2)
- The full Portfolio will include, inter alia, a logbook of procedures, marked case reports, signed logbook of procedures, and a statistical review of an article.
- A sub-minimum of 50% in each of the papers AND a sub-minimum of 50% in 75% of written questions is required to be eligible to be invited to the oral and OSCE examination.
- There must be a minimum of 10 stations in the OSCE examination. Candidates must pass a minimum of 75% of the OSCE stations in order to pass the OSCE.
- Candidates who achieve the required marks in the written component of the examination but who fail the oral and clinical examinations will be exempt from the written component of the next examination session.
- Such exemption applies to one sitting only and must be exercised in the following semester.
- If a candidate passes the written with an average of ≥ 60%, and passes the OSCE with an average of ≥ 60%, but fails one of the 3 oral stations with ≥ 45%, then examiners can agree to moderate the failing oral to 50%OR if this is not agreed to then a repeat oral will be done immediately by a second set of examiners and will be attended by the Part II moderator. The second oral must be passed with ≥ 55%.

8.3 Quality Assurance

The Ugandan Society of Clinical and Radiation Oncologists will be invited to constitute a panel to ensure quality assurance needs in learners' assessment process.

In order to ensure standards and for quality assurance, a process of 'moderation' of each examination is necessary.

A moderator, ideally a senior member of the sub-specialty, will be appointed, but not be part of setting up the exam. The moderator does not have to be internal to UCI.

Prior to the conduct of the written examination, the moderator will check that the examination questions and marking memorandum reflect a fair spread of the curriculum (reliability), match the curriculum (validity), and that the mark allocation of the questions is fair and appropriate.

8.4 Examinations

The examination will consist of fifteen (15) written papers as follows:

- Part I: Basic Sciences
    - Radiobiology
    - Radiation Therapy Medical Physics
    - Applied Radiological Anatomy
    - Treatment Planning, I
    -
- Part II: Clinical Oncology
    - Breast Oncology
    - Head and Neck Oncology

- Gastrointestinal Oncology
- Gynaecology Oncology
- Genitourinary Oncology
- Skin and Soft tissue Oncology
- Paediatric Oncology
- Neuro-Oncology
- Thoracic Oncology and Palliative Medicine
- Malignant Haematology and Medical Oncology
- Treatment Planning II

- Research Project
- A viva voce examination. This examination has to be passed.
- A practical examination (OSCE) which will be concerned with proficiency in clinical examination, technical aspects of radiotherapy as well as the investigation and treatment of patients, this will contain a minimum of 10 stations and will be conducted over a minimum of 2 hours. The candidate has to pass a minimum of 75%of OSCE stations.

8.5 Grading of examinations score

Status & Level	Description of Competence Features	% Range
Outright Fail [D]	• Has poor and inaccurate command of the subject vocabulary • Has poor and inaccurate command of the concepts (knowledge, skills and attitudes) of the subject across a broad range of topics.	44.9% & below
Bare Fail [D+]	• Has the basics of subject vocabulary • Has the basics of concepts (knowledge, skills and attitudes) of the subject across a broad range of topics • Unable to transfer and apply knowledge, skills and attitudes of the subject in a range of situations. • Unable to exercise independent judgement in a range of situations	45 – 49.9
Clear Pass [C]	• Has sound command of subject vocabulary • Has sound command of concepts (knowledge, skills and attitudes) of the subject across a broad range of topics • Able to formulate responses and demonstrate skill and exhibit appropriate attitude in well-defined and abstract problems/professional settings across a broad range of topics of the subject	50 – 64.9
Meritorious Pass [B]	All of the above in level 3 and: • Able to transfer and apply knowledge, skills, and attitudes and exercise significant independent judgment in a broad range of topics of the subject	65 – 74.9
Distinction Pass [A]	All of the above in level 4 and:	75% & above

	• Displays masterly of complex and specialized areas of knowledge, skills and attitudes in a broad range of topics of the subject.	

8.6 Statistics and Statistical Critique of a Published Article.

After completion of the Part I examinations, the candidate will provide a written statistical critique of a published article which will be marked and approved by the candidate's Head of Department. The aim is to empower the Fellow to become acquainted with Statistics as applied to Oncology at a similar time as undertaking the commentary.

8.7 Learning Portfolio

The Learning Portfolio documents the Fellow's experience. It includes a logbook and templates for the completion of case reports in Radiation Oncology, Medical Oncology, and palliative care.

The case reports should cover a broad range of disease sites and cover all major groupings of sites under the blueprint for the Part II examinations - that is breast, gynaecology, head and neck, upper gastrointestinal tract, lower upper gastro-intestinal tract, urology, respiratory, lymphomas, central nervous system as well as a miscellaneous group to include paediatrics and sarcomas.

In addition, Fellows will be encouraged to use the Learning Portfolio to learn applied basic sciences and the associated roles of an Oncologist in Health Care Practice

The Learning Portfolio is to be signed off by the Head of Department before the Fellow sitting the Part II examinations and needs to be presented to the examiners at the time of the Part II oral examination

The portfolio would be an essential part of the systematic collection of information that would help to monitor the professional development of the individual Fellow. The portfolio should be updated by the Fellow and should be countersigned by the supervisor for each of the recorded activities:

a) Section 1: Personal data: This section will include updated curriculum vitae (CV) with details of the local training programmes being followed, including visits to other institutes and registration numbers with the national licensing authority.
b) Section 2: Scientific training documentation and other courses: This section will include details of teaching courses and programmes attended within the institute or elsewhere.
c) Section 3: Clinical training documentation: This section should include details of all clinical rotations and a logbook recording all clinical procedures attended and/or performed by the Fellow
d) Section 4: Record of formal presentations by the Fellow: This section could include a copy of any handouts, overheads, copies of slides/PowerPoint presentations and written audit reports prepared for meetings within the department.
e) Section 5: Publications: This section will record posters presented at national or international meetings and copies of any scientific papers that may have been authored or co-authored by the Fellow.

8.8 Research Assignment

The award of the F Rad Onc Specialist Training Completion Certificate requires Fellows to complete a research project. The research assignment is an independent and cohesive component of activities in the training programme– as part of the research component

8.8.1 Objectives of the research assignment

The research assignment aims to ensure that candidate can;

- plan research;
- apply the literature study to the research;
- apply elementary statistical principles;
- conclude a project; and
- draw meaningful conclusions

8.8.2 Format of the research assignment

The structure of the research assignment will include;

- **Declaration** of the nature and extent of the contributions of the candidate and of collaborators;
- a **Table of Contents** with accurate page references;
- an **Abstract** in English;
- an **Introduction**, preferably not more than one page in length, briefly defining the topic of the research;
- a **Literature Review**, which focuses on the specific, demarcated area, elucidating the topic of the study and which should culminate in a **problem statement and/or hypothesis;**
- the **Aim of the Investigation**, which arises logically from the literature review and which may serve as the **motivation** for the study;
- the **Method** and **Materials** (experimental animals, patients, tissue culture, therapeutics, etc.);
- the **Results** or findings after quantitative or qualitative analysis, elucidated by clearly comprehensible tables, diagrams, graphs, etc., with appropriate annotations;
- the **Discussion**, in which the results are succinctly argued and interpreted in the light of the literature review, including a description of any limitations;
- the **Conclusion,** in which the findings, the interpretation thereof, and unresolved issues are concisely summarized. The chapter may close with a set of **recommendations** suggesting new approaches, clinical applications and/or further research projects; and
- the **List of References** in accordance with any acknowledged style.

The research will take place under the guidance of a supervisor, and comprise 20-25% of the total credit units of the programme. The Fellow will gain insights by means of methodical gathering and systematic processing of data and by way of clearly formulated problems, through which basic scientific knowledge can be expanded, application possibilities of exploiting knowledge scientifically or techniques and technology can be developed or improved scientifically.

8.8.3 Examples of research

Research assignments will be discussed with the supervisor and the department head to ensure relevance and feasibility within the training duration. These examples of research will include;

a. Prospective preclinical or clinical research.
b. Laboratory-based research
c. Goal-directed retrospective research, based on information available in-patient files.
d. Epidemiological research.
e. Health service system research.
f. A thorough critically assessed literature review that has already been accepted for publication in a (preferably subsidy-bearing) peer-reviewed scientific journal with the candidate as the first author.
g. Qualitative research.

h. Research on instruction/education/teaching.

8.8.4 Conduct of the research

8.8.4.1 Candidates

The candidate will be required to submit a protocol to the Programme Director before submission to the UCI research and ethics committee for approval. The protocol shall follow the designated format above. All research projects must receive ethical approval before undertaking any data collection. The candidate will work closely with their supervisor in the execution of the research project. Upon completion of the research assignment, the candidate will prepare two copies of the research assignment for submission to the head of the department and their supervisor for appraisal/marking by the internal and external examiners.

8.8.4.2 Programme director

The programme director will approve and appoint a supervisor to the Fellow during the first month of the training programme. The main supervisor shall be full or part-time staff of the Uganda Cancer Institute and specifically will be required to have interest in the candidate's area of the research assignment. They will familiarise themselves with all the formal provisions and requirements of dealing with the protocol, the research, the submission of the assignment, and its examination. The programme director will provide oversight to the selection of external examiners and the examination process including mediation of misunderstandings between the candidate and the Fellow.

8.8.4.3 Supervisors

The supervisors will be well acquainted with the research assignment process, ensure availability for the Fellow, and promote originality, scientific merit and research quality. The supervisors will ensure timely feedback to the Fellow and ensure regular supportive meetings, as well as attend discussions related with feedback from the examiners or programme director to the Fellow.

8.9 Annual Academic review

The annual review will be conducted by the programme director and/or the head of department, with the trainee's supervisor or consultant

The panel will make recommendations regarding the academic progress of the trainee as follows

8.9.1 Satisfactory Progress

Satisfactory Progress shall when a student has passed the Assessments in all the Courses, he/she had registered for in a particular academic year

8.9.2 Unsatisfactory

Unsatisfactory progress when either: -

- A student fails a compulsory course
- Such a student shall be allowed to progress to the next Semester/Academic Year but shall still retake the Course(s) he/she had failed the assessments in later on and obtain at least the Pass Mark in the Course(s).

8.9.3 Discontinuation

A student shall be discontinued from the programme if:-

a) He/she has received three consecutive probations on the compulsory course.
b) Professional misconduct.

8.10 Examination results

8.10.1 Approval of Examination Results

The programme director will convene a meeting with consultants involved in examinations and will approve all examination results. These results shall not be regarded as final until they are confirmed by the UCI training board. The appropriate Pass List will be accompanied with departmental minutes upon submission. A pass list will be published within 6 weeks of completing the exams and the programme director with the examinations office will ensure that a breakdown of each candidate's results is sent to them using the acceptable means such as email, or printed copy.

8.10.2 Appeals

Any student or candidate aggrieved by a decision of the programme director and departmental meeting (examinations board) may appeal to the advisory council for reversal or moderation of the decision of the examinations board.

9 TRAINEE SUPPORT

9.1 Mentorship Program

Mentoring during fellowship has a positive impact on the professional development of fellows. This involves pairing the fellow with a mentor to provide guidance and support throughout the fellowship program. The aim is to facilitate achieving the objectives of the fellowship program, maintain the well-being of the fellow, and provide advice with career development.

This involves two types of mentorships:

- Fellow-staff program

A staff member is paired with each fellow with the intention that this pairing continues over the four years of fellowship training. Mentees and their mentors will meet personally twice a year (or more if needed) to discuss research projects, career planning, or other professional issues.

- Fellow-fellow program

A junior fellow is paired with a senior fellow. The aim is to facilitate a smooth transition into the different roles and familiarize him/her with existing resources, policies, and procedures.

9.2 Fellow Safety and Security

Any fellow who is a victim of intimidation, harassment, or abuse during his/her training is strongly encouraged to promptly discuss this problem with the program director.

9.3 Radiation Safety

Radiation safety training

A formal radiation safety introductory course, structured and delivered by the training hospital, is to be delivered to the fellow during the first year of fellowship (during the radiation oncology first block).

Personal radiation monitoring devices (dosimeters)

Dosimeters must be issued to each fellow at the teaching site. It is expected that dosimetry reports will be available to the fellow.

Emergency procedure for a brachytherapy source emergency

A formal teaching session with regard to the procedures of handling a stuck radioactive source.

Declaration of pregnancy

Given the effects of radiation on the fetus, a radiation dose to the fetus that results from occupational exposure of the mother should not exceed 4mSV during the period of gestation.

Fellows who become pregnant must declare their pregnancy immediately to the radiation safety officer or to the program director.

The fellow then has to be reassigned throughout her pregnancy in order to not increase the risk of exposure (avoid rotations where brachytherapy is used); a special fetus monitor will be provided.

9.4 Reading and Reference Materials

The following reference books are recommended:

- DeVita, Hellman, and Rosenberg's Cancer: Principles and Practice of Oncology (Cancer: Principles & Practice (DeVita) Ninth, North American Edition by Vincent T. DeVita Jr. MD, Theodore S. Lawrence MD PhD, Steven A. Rosenberg MD PhD. Lippincott Williams & Wilkins, 2011
- Perez & Brady's Principles and Practice of Radiation Oncology by Dr. Edward C. Halperin MD, Dr. David E. Wazer MD, Dr. Carlos A. Perez MD and Dr. Luther W. Brady MD. Wolters Kluwer, 2019
- Clinical Radiation Oncology by Leonard L. Gunderson MD MS FASTRO, Joel E. Tepper MD. ELSEVIER 2015
- Radiobiology for the Radiologist by Eric J. Hall, Amato J. Giaccia. Lippincott Williams & Wilkins, 2012
- The Physics of Radiation Therapy by Faiz M. Khan, John P. Gibbons. Lippincott Williams & Wilkins, 2014
- Basic Science of Oncology by Ian F. Tannock, Richard P. Hill, Robert G. Bristow, Lea Harrington Fifth Edition. McGraw-Hill International Editions 2013

Journals:

- Radiotherapy & Oncology
- International Journal of Radiation Oncology, Biology & Physics
- British Journal of Radiology Cancer
- Lancet Oncology
- New England Journal of Medicine
- Journal of Clinical Oncology
- Journal of the National Cancer Institute

Other textbooks include:

- **Suggested books for Year 1**
- Tortora JT & Grabowski SR, Principles of Anatomy and Physiology, (10th Edition), Harper Collins.
- Guyton AC, Human Physiology and Mechanisms of Disease, W.B. Saunders.
- Robbins A: Handbook of Pathology.
- Snell, R.S. Gross Anatomy, Little, Brown & Co.
- Weir, J. & Abrahams, P. Imaging Atlas of Human Anatomy.
- Graham, D. Principles of Radiological Physics Churchill Livingstone.
- Hendee, W.R, & Ibbott, J.S. Radiation Therapy Physics. (3rd Edition) Mosby.
- Williams, J.R., & Thwaites, D.I. Radiotherapy Physics. Oxford Medical Publications.
- Bomford, C. & Kunkler, I. Walter and Miller's Textbook of Radiotherapy, Radiation Physics, Therapy & Oncolog Churchill Livingstone.
- Ball, J.L, & Moore, A.D. Essential Physics for Blackwell Science.
- Martin, A.M., & Harbison, S.A. An Introduction to Radiation Protection. Chapman & Hall Medical.
- International Commision on radiological Protection Radiation Protection-ICRP 60. Oxford Pergamon Press.
- Health & Safety Executive (HSE). The Ionising Radiation Regulations. HMSO.
- McKenzie, A.L., Shaw, J.E., Stephenson, S.K., & Turner, P.C.R. Radiation Protection in Radiotherapy, Report No. 46. The Institute of Physical Sciences in Medicine.
- Nias A, An Introduction to Radiobiology, John Wiley and Sons.

- **Suggested Books for Year 2**

- Griffiths S & Short C, Radiotherapy: Principles to Practice. A Manual for Quality in Treatment Delivery, Churchill Livingstone.
- Dobbs J, Barrett A, & Ash D, Practical Radiotherapy Planning, Edward Arnold.
- Bentel GC, Radiotherapy Planning, McGraw-Hill Inc.
- Taylor J, Imaging in Radiotherapy, Croom Helm.
- Bomford C & Kunkler I, Walter & Miller's Textbook of Radiotherapy, Radiation Physics, Therapy & Oncology, Churchill Livingstone.
- Southamie R & Tobias J, Cancer and Its Management, Blackwell.
- Bouma GD, Statistics and the Research Process, Oxford University Press.
- Polgar S & Thomas SA, Introduction to Research in the Health Sciences, Churchill Livingstone.

- **Suggested Books for Year 3 and 4**

- Ellis H, Logan BM, & Dixon A, Human Cross-Sectional Anatomy: Pocket Atlas of Body sections and CT and MRI Images, Butterworth-Heinemann.
- Han, MC & Kim CW, Atlas of Sectional Human Anatomy Correlated with CT and MRI, Igakuu-Shoin.
- Sutton D & Young JWR, A Short Textbook of Clinical Imaging, Springer-Vertag.
- Burnard P. Effective Communication Skills for Health Professionals, Stanley Thomas.
- Souhamie & Tobias JS, Cancer and Its Management, Blackwell.
- Faulkner A & Maguire P, Talking to Cancer Patients and Their Relatives, Oxford University Press.
- Aitkin V & Jellicoe H, Behavioural Science for Health Professionals, WB Saunders.
- Kantor JE, Medical Ethics for Physicians in Training, Planum Publishing.

10 Training Resources and Budget

10.1 Tuition fees and other student requirements

This is a privately sponsored programme. The course will be self-supporting mainly from student's tuition fees. Students have the responsibility to meet their own financial obligation including tuition fees, scholastic materials, transport and living costs. Provisional budget and basic requirements

Items	Ugandans UGX	Non-Ugandans
Tuition fee	7,000,000.00 per year	USD 7,000.00 per year
Application fee	50,000.00	UGX 151,500.00
Registration fee	120,000.00	UGX 202,000.00
Administration fee	200,000.00	UGX 484,800.00
Library fee	20,000.00	UGX 40,400.00
Examination fees	200,000.00	UGX 707,000.00
Technology	80,000.00	UGX 161,600.00
OTHER STUDENT REQUIREMENTS		
Books, Stationery and materials	400,000.00	USD 400.00
Accommodation	1,000,000.00	USD 1,400.00
Food	750,000.00	USD 1,800.00

Transport Allowance	900,000.00	USD 1,800.00
Stipend	900,000.00	USD 1,800.00
Vacation Supplement (per day)	10,000.00	USD 10.00
Research Expenses	5,000,000.00	USD 300.00
Insurance	120,000.00	USD 5,000.00

10.2 Financial Resources (Budget)

The program is privately sponsored apart from those students who qualify for Government sponsorship. No tuition will be charged for the recess term

INCOME PER 4-YEAR				
Tuition fee per year (Ug. Shillings)	Number of paid semesters @ year	Total number of students in the 4 years of study (10 students per year)	Number of years of study for the program	Total income for all the 4 years (Ug. Shillings)
7,000,000	2	40	4	280,000,000

EXPENDITURE PER 4-YEAR		
ITEM	Rate	Amount (Ug. Shillings) per 4 years
A) Teaching Expenses		
For 2295 contact hours	20000shs per contact hour	**45,900,000.00**
B) Administration		
Transport	500,000.00 per semester	4,000,000.00
Exam's coordinator	90,000.00 per semester	720,000.00
Secretary	60,000.00 per semester	480,000.00
SUBTOTAL		**51,100,000.00**
C) Vote Details	Rate per semester	Amount (Ug. Shillings)
2010 Office tea and entertainment	200,000	1,600,000.00
3030 Material supplies/ office expenses	200,000	1,600,000.00
SUBTOTAL		**3,200,000.00**
1. Stationery		
Item per each year of study	Unit cost	The amount for the 4 years (Ug. Shillings)
Duplicating paper, 6 reams	10,000	240,000.00
Photocopying paper 15 reams	15,000	900,000.00
Flip chart (6)	20000	480,000.00
Ruled paper 6 reams	8,000	192,000.00

Manila paper 5 dozen	15,000	300,000.00
White board (2)	55,000	440,000.00
Markers 5 packets	12000	240,000.00
5 Cartridges	120,000	2,400,000.00
Assorted Envelopes	30,000	120,000.00
Chalk: 6 boxes	15,000	360,000.00
Reading TLDS (8 readings in 4 years, for 10 students)	10000 per TLD reading	1,600,000.00
Ball pens 10 packets	10,000	400,000.00
Departmental Meetings		2,000,000.00
SUBTOTAL		**9,672,000.00**
Grand total Expenditure		**91,872,000.00**

11 REFERENCES

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians. 2021.
2. Uganda Cancer Institute REPUBLIC OF UGANDA MINISTRY OF HEALTH. .
3. Datta NR, Samiei M, Bodis S. Radiation therapy infrastructure and human resources in low- and middle-income countries: Present status and projections for 2020. International Journal of Radiation Oncology Biology Physics. 2014;89(3):448–457.
4. 36 IAEA Syllabus for the Education and Training of Radiation Oncologists Endorsed by the American Society for Radiation Oncology (ASTRO) and the European Society for Therapeutic Radiology and Oncology (ESTRO) V I E N N A , 2 0 0 9. 2009.
5. Clinical Oncology Specialty Training Curriculum. .
6. RADIATION ONCOLOGY TRAINING PROGRAM CURRICULUM. 2021.
7. ZAMBIA COLLEGES OF MEDICINE & SURGERY Specialty Training Programme (STP) Curriculum & Learning Guide for Clinical Oncology (2017). .
8. Acgme. ACGME Program Requirements for Graduate Medical Education in Radiation Oncology. .

12 APPENDIX

12.1 Appendix 1: End of rotation Fellow Evaluation and feedback–

Date……

The aim is be helpful to the Fellow's development.

Name of Fellow being appraised	
Name of appraising specialist	
Rotation and Date	

	Clear failure (1)	Border-line (2)	Clear pass (3)	Exceeds expectation (4)	Not applicable
A. Medical Expert					
Basic and Clinical Knowledge					
1. Understands the basic and clinical science and pathophysiology of common medical illnesses					
2. Understands the clinical presentation, natural history, and prognosis of common medical illnesses					
3. Demonstrates expertise in all aspects of the diagnosis and management of common medical illnesses					
4. Practices contemporary, evidence-based and cost- effective medicine					
5. Avoids unnecessary or harmful investigations or management					
6. Provides care to diverse communities					
7. Demonstrates the appropriate knowledge, skills, and attitudes relating to gender, culture, and ethnicity					
8. Complete an accurate history and physical examination					
9. Formulates appropriate differential diagnoses					
10. Develops an appropriate plan of investigation and interpret the results					
11. Develops a therapeutic plan					
12. Develops a plan of secondary prevention					

13. Demonstrates appropriate clinical judgment					
14. Demonstrates knowledge of the medications used; mechanisms of action; clinically relevant pharmacokinetics, indications, contraindications, and adverse effects					
Procedural skills					
15. Understands the indications, contraindications, and complications of specific procedure					
16. Demonstrates mastery of specific procedure techniques					
B. Communicator					
17. Writes appropriate progress notes, and transfer and discharge summaries					
18. Communicates appropriately with junior medical, nursing, and allied health staff					
19. Communicates appropriately with patients					
20. Appropriate communication with patients' families					
21. Establishes therapeutic relationships with patients/families					
22. Delivers understandable information to patients/families					
23. Provides effective counseling to patients/families					
24. Maintains professional relationships with other health care providers					
25. Provides clear and complete records, reports, informed and written consent					
C. Collaborator					
26. Works effectively in a team environment					
27. Able to work with allied health care staff					
28. Able to work with nursing staff					

29. Able to work with attending and junior medical staff					
30. Consults effectively with other physicians and other health care providers					
D. Manager					
31. Participates in activities that contribute to the effectiveness of their healthcare organizations and systems					
32. Manages their own practice and career effectively					
33. Allocates finite healthcare resources appropriately					
34. Serves in administration and leadership roles, as appropriate					
35. Utilizes information technology to optimize patient care, lifelong learning, and other activities					
E. Health advocate					
36. Attentive to preventive measures					
37. Demonstrates adequate patient education on compliance and role of medications					
38. Attentive to issues of public policy for health					
39. Recognizes important social, environmental, and biological determinants of health					
40. Demonstrates concern that patients have access to appropriate supports, information, and services					
41. Offers advocacy on behalf of patients at practice and general population levels					
F. Scholar					
42. Attends and contributes to rounds, seminars, and other learning events					
43. Appropriately discusses and presents selected topics as requested					
44. Demonstrates adequate ability to search literature					

45. Demonstrates efforts to increase knowledge base					
46. Accepts and acts on constructive feedback					
47. Reads around patient cases and takes an evidence- based approach to management problems					
48. Contributes to the education of patients, house staff/students, and other health professionals					
49. Contributes to the development of new knowledge					
G. Professional					
50. Recognizes limitations and seeks advice and consultation when needed					
51. Understands the professional, legal, and ethical obligations of physicians					
52. Delivers evidence-based care with integrity, honesty, and compassion					
53. Demonstrates appropriate insight into own strengths and weaknesses					
54. Exercises initiative within limits of knowledge and training					
55. Discharges duties and assignments responsibly and in a timely and ethical manner					
56. Reports facts accurately, including own errors					
57. Maintains appropriate boundaries in work and learning situations					
58. Respects diversity of race, age, gender, disability, intelligence, and socio-economic status					
Total Score	Total score = ---------- ---------- X 25 = 100% Number of evaluated items =				

12.2 Appendix II: Programme Supervisor's Annual Review

Fellow's Name:

Date of start of Rad Onc training:

S = Satisfactory M = Marginal US = Unsatisfactory NA = Not Applicable

Year of Training	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Date of End training year				
Assessment Date				
Clinical Skills				
Planning and RT skills				
Clinic engagement/chemotherapy				
Procedures in Learning Portfolio				
Communication skills				
Case reports				
Log book/portfolio completion				
Academic Presentations				
Admin and leadership				
Research project progression				
Research supervisor:				
Remedial action Y/N				
Remedial action supervisor				
Part I F Rad Onc obtained				
Part II F Rad Onc obtained				

Comments Year 1

.....

.....

Programme Supervisor:

_____

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

Comments Year 2 ....

Programme Supervisor:

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

Comments Year 3 ....

Programme Supervisor:

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

Comments Year 4 ....

Programme Supervisor:

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

12.3 Appendix 3: PORTFOLIO OF LEARNING

Specialist Training in Radiation Oncology, at the Uganda Cancer Institute

Contents of the PORTFOLIO OF LEARNING
Part A

SECTION 1 Candidate Details

SECTION 2 Submission to special committee on examinations for entry into exams:

a) HoD letter for Part 1 submission
b) Checklist for Part 2 submission:
    i. Candidate declaration
    ii. HoD letter template
    iii. List of case reports
    iv. Marked statistical review of an article

SECTION 3 Summary of training in Radiation Oncology

SECTION 4 Procedures Logbook

SECTION 5 Case reports

a) 10 Case reports– General Oncology
b) 15 Case reports– Radiotherapy
c) 5 Case reports - Palliative care

SECTION 6 Clinical practice rating and evaluation

SECTION 7 Presentations and publications

SECTION 8 Learning and Research

Part B

APPENDIX (a) Purpose of the portfolio of learning
Learning objectives for individual rotations or attachments
(b) Structured guide to procedures

SECTION 1

CANDIDATE DETAILS

SURNAME:

FIRST NAMES:

ID NUMBER:

UMDPC NUMBER:

TRAINEE POST NUMBER:

DEPARTMENT:

……..

RESIDENTIAL ADDRESS:

……..

……..

PREFERRED POSTAL ADDRESS:

…….

…….

EMAIL ADDRESS:

TELEPHONE NUMBER: (Work): ……. (Home): ……

CELLPHONE NUMBER:

UNDERGRADUATE MEDICAL QUALIFICATIONS

UNIVERSITY: YEAR:…….

1. INTERNSHIP

HOSPITAL: YEAR:…….

TRAINING EXPERIENCE:

2. COMMUNITY SERVICE

HOSPITAL: YEAR:…….

TRAINING EXPERIENCE:

3. ADDITIONAL POST-GRADUATE TRAINING EXPERIENCE
(Prior to commencement of *[discipline specific]* Fellow Rotation)

STATUS	**HOSPITAL**	**DEPARTMENT**	**COUNTRY**	**DURATION & DATES**

……

……

……

EXAMINATION DETAILS:

PART 1 F RAD ONC OBTAINED: MONTH:……YEAR:…….

4. OTHER REGISTERABLE POST-GRADUATE QUALIFICATIONS:

DIPLOMA/DEGREE: YEAR:……

INSTITUTION:

DIPLOMA/DEGREE: YEAR:……

INSTITUTION:

6.

SECTION 2(a) Part 1 HoD letter

The Convenor
Special committee on Examinations

Dear Convenor
ENTRANCE TO F RAD ONC(UCI) PART I EXAMINATION
Name of Candidate: .....…….
I, ……, Head of department of Radiation Oncology at ……..hereby confirm that the above candidate meets the following criteria of eligibility for entrance to the F Rad Onc Part I examination:

1) The candidate is currently in the following numbered Fellow training post:

Post number: .....

2) The candidate has completed a minimum of 6 months in an accredited department:

Dates: ..... to .....

Yours sincerely

Signature…….....……. Date: .....

Department: …….

2(b)
CHECKLIST FOR PART 2 SUBMISSION
Submit a copy at time of Registration for Part II Examination
NAME:
INSTITUTION:
START DATE OF FELLOW TRAINING:
COMPLETION DATE OF FELLOW TIME:
DATE OF COMPLETION PART I:
DATES OF ENTRY INTO PART 2:

CANDIDATE DECLARATION Yes/No
HEAD OF DEPARTMENT LETTER Yes/No Date of letter:
30 CASE REPORTS COMPLETED Yes/No
STATISTICAL REVIEW Yes/No
LOG BOOK COMPLETED Yes/No

2(b)i) DECLARATION
(To be completed by candidate)

I, ……. hereby do solemnly declare that all information contained in this PORTFOLIO OF LEARNING is a true and accurate record of my professional experience, education and training from ……. to …… representing the period of training for the *F Rad Onc* qualification.

Signature of Candidate:

Trainee Number:

Date:

SECTION 2b(ii) HoD letter

The Convenor
Special Committee on Examinations

Dear Convenor
ENTRANCE TO F RAD ONC PART II EXAMINATION
Name of Candidate: .....…….
I, ……, Head of department of Radiation Oncology at ……..hereby confirm that the above candidate meets the following criteria of eligibility for entrance to the F Rad Onc Part II examination:

1) The candidate has been in the following numbered Fellow training post for a minimum of 3 years in an accredited department:

Number: .....
Dates: ..... to .....

2) Passed the F Rad Onc Part I during the last six years: Date: .....
3) That the candidate is deemed to have performed adequately during annual academic assessments throughout the Fellow period. Yes/No
4) The candidate has completed 30 case reports to the satisfaction of his/her supervisor. These are marked and should be submitted at the time of the OSCE/oral examination. Yes/No
5) The candidate has completed a Portfolio of learning in line with the syllabus. This has been signed off by the supervising specialists and will be tabled at the time of the oral examination. Yes/No
6) The candidate has completed a short course on statistical methods for clinical research as well as a statistical review of an oncology article in line with the syllabus. This has been marked as adequate by his/her supervisor and will be made available as part of the portfolio at the time of the oral examination. Yes/No

Yours sincerely

Signature…….....……. Date: .....
Department: …….

SECTION 2 b) iii)– List of Case Reports

No.	Date	Subject	Type of case report (General/Radiation technique/palliative care)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
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28			
29			
30			

HoD SIGNATURE: …….

SECTION 2 b) iv)- Statistical review of an Article
(Please insert the following)

1. Copy of PDF of chosen article.
2. Original marked copy of statistical review
3. Certificate of attendance at statistical methods course

Guide for statistical appraisal

Aim:
The aim of the statistical review is to test the Fellow's knowledge of practical statistics. The report should be no more than 2 pages. It is suggested that a recent Part 3 study is chosen for review.
Process:
The report is marked within each Radiation Oncology Department and included in the portfolio of activities (logbook) which gets handed into the College at the time of Part 2 orals.
Suggested format:
1. What is the aim of the study and the hypothesis being tested?
2. What is the Part of the clinical study and what level of evidence will it contribute?

Comment on:
a) What are the eligibility criteria of the study patients and are the patient characteristics well-defined and comparable between the treatment arms?
b) Are the treatment interventions in the test and in the control arm clearly described?
c) Does the control arm consist of best standard care if it is a Phase 3 study?
d) What are the main endpoints?
e) How was the sample size determined?
f) What were the types of statistical tests done in this study?
g) Did the study define a probability or error, hazard ratio and a confidence interval? What do these mean?
h) What do the findings mean in terms of the aims of this study?

(Note – some of the above will not apply to Phase II studies therefore it is suggested that a Phase III study is chosen for review. If a Phase II study is chosen the Fellow should state that the test was not done as it was not a Phase III, but should make a short note to indicate what they understand by the term.)

SECTION 3
SUMMARY OF TRAINING DURING FELLOW
ROTATION IN RADIATION ONCOLOGY

Year of training 1

Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:

Year of training 2

Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.

Supervising consultant:…… Signature of consultant:

Year of training 3
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Year of training 4
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.
Supervising consultant:…… Signature of consultant:
Rotation: …… Period:.

Supervising consultant:…… Signature of consultant:

SECTION 4– Procedures Log book

7. INSTRUCTIONS FOR PROCEDURES LOG BOOK

1. **A separate page of "Record of Procedures" must be completed for each rotation e.g., breast, Gynaecology, Urology etc. and signed off regularly (egg monthly) during your training. It is your responsibility to arrange a suitable time with your supervisor to do this.**

2. **The log book should be an ongoing process from the commencement of your training and should reflect all cases seen and managed by you.**

3. **Procedures must be noted sequentially and *not retrospectively.***

4. **The details of your involvement with each case needs to be provided. (Simply stating "breast mark-up", or "prostate volumes" is insufficient.)**

5. **Radiotherapy and chemotherapy procedures should be documented.**

6. **Your involvement with each case must also be marked in the 'status' column as described. (Performed independently, Assisted, Observed)**

NAME: _____

8. **ROTATION: _____**
9.

DATES: From_____ To_____

RECORD OF PROCEDURES

Status of Activity: P = Performed independently; A = Assisted; O = Observed;

Date	Hosp. No	Rad/Pal	Procedure	Status

Signature(consultant)…….
Date…….

SECTION 5- case reports

Instructions:

1. 30 case reports should be completed during the 4 years of Fellow training. 5 case reports per year should be submitted to supervisor consultant for marking.
2. The case reports are aimed at self-reflection. The Fellows should choose cases in which a particular skill was learned and discuss this. It is not meant to be a topic review or review of the literature regarding an oncology topic.
3. Case reports required:
   a) 10 Case reports– General Oncology
   b) 15 Case reports– Radiotherapy
   c) 5 Case reports palliative care

Case report templates for a), b), and c) are included as Appendix B.

SECTION 6

Clinical practice rating and evaluation

These evaluation sheets must be completed by the candidate's supervisor during and at the end of each rotation, and must be discussed with the candidate. Sheets should be numbered and presented in chronological order.

All assessments should also be evaluated annually and discussed with each Fellow by the HoD/director of training in the department.

A suggested format for end of block and annual assessments is included below.

PROGRAMME SUPERVISOR'S ANNUAL REVIEW (Rad Onc)

Fellow:

Date of start of Rad Onc training:

S = Satisfactory M = Marginal US = Unsatisfactory NA = Not Applicable

Year of Training	Year 1	Year 2	Year 3	Year 4
Date of End training year				
Assessment Date				
Clinical Skills				
Planning and RT skills				
Clinic engagement/chemotherapy				
Procedures in Learning Portfolio				
Communication skills				
Case reports				
Log book/portfolio completion				
Academic Presentations				
Admin and leadership				
Research project progression				
Research supervisor:				
Remedial action Y/N				
Remedial action supervisor				
Part 1 F Rad Onc obtained				
Part 2 F Rad Onc obtained				

Comments Year 1 .....

Programme Supervisor:

_____

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

Comments Year 2 .....

Programme Supervisor:

_____

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

Comments Year 3 .....

Programme Supervisor:

_____

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

Comments Year 4 .....

Programme Supervisor:

_____

(Print Name) **(Signature)**

Fellow:

(Print Name) **(Signature)**

SECTION 7

10. LEARNING AND RESEARCH

PRESENTATIONS GIVEN BY CANDIDATE DURING TRAINING:

1. Date	Topic	Duration	Event	Venue
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				

PAPERS PRESENTED AT CONFERENCES BY CANDIDATE:

26. Date	Topic	Duration	Event	Venue
27.				
28.				
29.				
30.				
31.				
32.				
33.				
34.				
35.				
36.				
37.				
38.				
39.				
40.				

ANY OTHER MISCELLANEOUS EXTRA-CURRICULAR LEARNING EXPERIENCE RELEVANT TO *DICIPLINE-SPECIFIC*:

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JOURNAL PUBLICATIONS BY CANDIDATE:
(Attach 1st page of Article)

1. Name of Journal	Vol. & No	Full Title	Pages
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			

RESEARCH INVOLVEMENT BY CANDIDATE:

Type of Involvement / Details of Project(s):

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……

……

Verified by: Signature:……Date:……

Name:……. Contact No:…….

F Rad Onc

Part B

APPENDIX A

Purpose of the portfolio of learning
What is the Portfolio?

Your portfolio is based on the "CRITICAL" Portfolio (*Certified Record of In-service Training Including Continuous Assessment and Learning*). It is a professional resource document structured in a flexible format which allows trainees to plan and meet the objectives of the specialty training programme through a *documented* process of work experience, learning and reflection.

Purpose of the portfolio

1. To stimulate students to think consciously and objectively about their own training. (This is known as *reflective* learning). This is its primary purpose.
2. To document the scope and depth of the candidate's training experiences.
3. To provide a record of the trainee's progress and personal development as training proceeds.
4. To provide an objective basis for discussion with the candidate's supervisors about work performance, objectives, and immediate and future educational needs.
5. To provide documented evidence for the special committee on examination to assess the quality and intensity of the training the trainee has undergone.

The portfolio is not just a logbook of signed procedures undertaken or witnessed. It should contain the candidate's written reflections and systematic documentation of his/her learning experience. It includes opportunities for candidates to reflect, to explore, to form opinions, and to identify the strengths and weaknesses in their own abilities and knowledge. It provides the facility for trainees to follow their own progress, not only through the training programme, but also towards the learning goals they have set for themselves. In this way the portfolio provides an opportunity to record and document the subjective aspects of training.

Objectives

For the trainee, the objectives of the portfolio are to:

- develop a structured learning plan
- identify goals and actions required to achieve them
- record progress in achieving those goals
- document personal strengths
- identify areas needing improvement
- reflect on progressive professional development
- encourage quality two-way communication with supervisors
- provide documentation for the continuous evaluation, review and direction of one's progress.

Who looks at the Portfolio of Learning?

1. The candidates. The primary audience are the trainees themselves.

2. Supervisors. It is expected that candidates formally meet with their supervising consultant at least twice during each rotational block. At this meeting, supervisors will review the candidate's progress and should use entries in the portfolio as a basis for discussion. This allows a structuring of the supervision process. By referring to and discussing specific areas of learning and experiences, the supervisor is able to provide informed feedback and constructive advice with regard to problems and deficiencies. In this way the portfolio allows a structuring of the supervision process.

Candidates will also undergo formal assessments annually, by a committee of senior consultants. The candidate is required to present their portfolio at each of these assessments.

3. The UCI. The UCI requires evidence that learning has taken place as part of a structured programme. The portfolio is an important piece of evidence for this.

This portfolio is a guide and cumulative record of your personal learning, goals, needs, strategies and activities throughout your training programme. The sections in the portfolio are not exhaustive, but rather an indication of the minimum that you should be doing. You will learn a great deal more than what is written on these pages. We trust that this will provide you with a positive and valuable learning experience.

Portfolio Completion Criteria

- The Portfolio should always be used in conjunction with the Regulations and Syllabus for admission to the Fellowship in Radiation Oncologists. F Rad Onc, as may be amended from time to time.
- Entries must at all times be legible and, where indicated, supported by the required signatories (Supervising Consultants and Heads of Departments and their contact details). Add pages to each Section as necessary. Ensure that your name appears on every page. It is strongly advised that you keep an electronic backup copy of all entries, as well as a printed copy, in case of computer failure or theft.
- Each Rotation will need to be verified by the relevant Head of Department, including the completed "Record of Procedures Done" and "Clinical Practice Rating and Evaluation" for each Rotation.
- The portfolio summary and supporting certificates and documents must be electronically uploaded to the special committee on examination at the time of entry into the Part 2 examination. The following documents are required:
    - Checklist for Part 2 submission
    - Declaration by candidate
    - HoD letter
    - List of case reports (30)
    - Marked statistical review
    - Summary of training
- Failure to submit these documents at the time of entry to Part 2 examination will result in the candidate not being invited to the examination.

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Learning objectives for individual rotations or attachments

At the start of each rotation or attachment, the trainee should list the learning objectives they have set for themselves for the duration of that attachment. These should be updated as the rotation progresses.

On completion of the rotation, the trainee should reflect on the progress made in meeting those objectives, and identify areas in which learning weakness remains.

At a date after completion of the rotation this page should be reviewed with a supervisor, discussed and must then be signed off. This may be with the person in charge of that rotation, or with a mentor or supervisor at the next formal review session, according to local policy.

Note that this is not an assessment of the trainee's work during the attachment. It is an exploration of his or her *insight* into the learning appropriate to that rotation and the extent to which it has been achieved.

APPENDIX B

CASE REPORT FORMS:

a) General Oncology (10)
b) Radiation therapy (15)
c) Palliative care (5)

Suggested marking rubric as attached.

All case reports should be signed by a consultant as marked and adequate.

Radiation Oncology Training

a) General Oncology Case Report Form

FELLOW

NAME: …… Date: ……

CASE IDENTIFICATION

RT No: …… Consultant in Charge: ……

Patient Details:

Initials: …… Date of Birth: …… Age at time of report: ……

ONCOLOGY SUMMARY

Diagnosis (histology, stage, site)

Brief Summary of Case

Further Clinical Summary

Include features of history, examination and investigations relating to THIS treatment

MANAGEMENT PLAN

REASON FOR CHOICE OF TREATMENT
Please be specific to THIS patient

TREATMENT DETAILS

Potential benefits of treatment

Potential toxicities of treatment ± comment on actual acute/late toxicities

Describe your role in treating this patient

Reflect on specific skills learned through this case/special features of this case

Signatures:

Fellow:
……..

Year of Specialist Training:
……..

Specialist:
…….

Radiation Oncology Training

b) Radiation therapy Case Report Form

FELLOW

NAME: …… Date: ……

CASE IDENTIFICATION

RT No: …… Consultant in Charge: ……...

Patient Details:

Initials: …… Date of Birth: …… Age at time of report: ….

ONCOLOGY SUMMARY

Diagnosis (histology, stage, site)

Brief Summary of Case

MANAGEMENT PLAN

PLANNED TREATMENT AND REASON FOR CHOICE OF TREATMENT
Please be specific to THIS patient

TREATMENT DETAILS

Include sedation, positioning, immobilization and CT instructions

Comment on contouring of target volumes and critical OAR dose constraints

Comment on type of planning (2D vs 3-D vs IMRT vs VMAT) and describe technique used for this patient

Comment on the quality assurance for this plan

Comment on potential benefits of treatment as well as potential toxicities/actual toxicities of treatment

Describe your role in treating this patient

Comments on specific skills learned through this case/special features of this case

Signatures:

Fellow: ……

Year of Specialist Training: ……

Specialist: ……

Radiation Oncology Training

c) Palliative care Case Report Form

FELLOW

NAME: …… Date: ……

CASE IDENTIFICATION

RT No: …… Consultant in Charge: ……...

Patient Details:

Initials: …… Date of Birth: …… Age at time of report: …….

ONCOLOGY SUMMARY

Diagnosis (histology, stage, site)

Brief Summary of Case

Management plan

REASON FOR CHOICE OF TREATMENT
Please be specific to THIS patient

Describe your role in treating this patient

Reflection on this case. i.e., specific palliative care skills you learned through this case/special features of this case

Signatures:

Fellow: ……

Year of Specialist Training: ……

Specialist: ……