

RESIDENCY TRAINING PROGRAM IN RADIATION ONCOLOGY

King Hussein Cancer Center



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Welcome to King Hussein Cancer Center Radiation Oncology Residency Program

The Radiation Oncology Residency Program at King Hussein Cancer Center (KHCC) was established in 2004. It is a four-year training program that is accredited by Jordan Medical Council for Board Certification in Radiation Oncology.

KHCC is the only comprehensive cancer center in the Kingdom where we provide cancer care for patients from Jordan and Middle East. It is accredited by the Joint Commission International (JCI) since 2006 and boasts a special accreditation as disease specific hospital since 2008. It also has several international and local accreditations for various departments and functions including the College of American Pathologists (CAP) lab accreditation, the Healthcare Accreditation Counsel (HCAC) for Breast imaging unit, the US National Cancer Registrar Association (NCRA) certification and the MAGNET accreditation for nursing excellence. KHCC pioneered the concept of comprehensive cancer care through the establishment of Multidisciplinary Teams (MDTs) for almost every cancer site and Clinical Practice Guidelines (CPGs). Through our key agreements with world renowned hospitals in North America, Europe and UK the center provides a high-quality physician training and cancer care.

The Radiation Oncology Department at KHCC was found with the establishment of the center in 1997 as a recognized leader of clinical and scientific radiation related directives in Jordan and in the region. Our facility is located in two locations within the center's premises. The basement floor of Nizar AlNaqib Building hosts 4 Linear Accelerators (LINAC), one CT simulator, High Dose Rate (HDR) Brachytherapy suite, radiotherapy planning room and 4 outpatient clinic rooms. The ground floor of King Salman Building hosts two LINACs, a CT simulator, radiotherapy planning room and 2 outpatient clinic rooms. All these six state of art LINACs are from Elekta and are equipped with the latest technologies of image guided radiotherapy (IGRT). Our treatment Planning System (TPS) is Pinnacle and the department workflow is carried out with MOSAIQ system. Most of the treatments are delivered via Intensity Modulated Radiotherapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT). Stereotactic radiosurgery (SRS) and Stereotactic body radiotherapy (SBRT) are other forms of radiation that are routinely delivered at our institution.

The comprehensive goals of the Radiation Oncology Department are to provide optimal radiation therapy for the patients, to increase cancer's curability while minimizing the adverse normal tissue effects of cytotoxic therapy, to conduct clinical research and to train physicians to provide excellent oncologic care and conduct meaningful research while encouraging them to orient their careers in the direction of academic radiation oncology.

We provide this training curriculum that was prepared from multiple references (1). Its aim is to provide guidance for trainees and faculty of the training objectives and structure of the program.

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Director - Radiation Oncology Residency Program

(1) References:

- ACGME International Advanced Specialty Program Requirements for Graduate Medical Education in Radiation Oncology, 2016.
- IAEA Syllabus for the Education and Training of Radiation Oncologists, 2009.
- ASTRO's 2015 Physics Curriculum for Residents
- ASTRO's 2015 Radiobiology Curriculum for Residents
- ACR TXIT™ Exam Outline
- Curriculum Goals and Objectives, H. Lee Moffitt Cancer Center & Research Institute at the University of South Florida
- Residency Training Program in Radiation Oncology, University of Rochester Medical Center
- Introductory Radiation Oncology Curriculum (IROC), Jimenez RB *et al*, *Int J Radiat Oncol Biol Phys*. 2020;107(3):408-416.

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I. Introduction and Definitions

Cancer is one of the leading causes of death globally and cancer incidence is predicted to increase worldwide. Almost 16% of all deaths worldwide are caused by cancer, second to cardiovascular diseases. In 2018, there were more than 9.5 million cancer deaths worldwide and 18 million newly diagnosed cases of cancer. By 2040, the global burden is expected to grow to 27.5 million new cancer cases and 16.3 million cancer deaths simply due to the growth and aging of the population. In Jordan, there were more than 8000 new cases in 2016; more than half of them were treated at KHCC.

Radiotherapy plays a fundamental role in the continuum of cancer care. Radiotherapy or “radiation therapy” is a clinical modality dealing with the use of ionizing radiation in the treatment of patients with malignant neoplasia (and occasionally benign diseases). Radiation oncology is a medical specialty concerned with the causes, prevention, treatment, and follow-up of cancer and certain non-neoplastic conditions utilizing ionizing radiation. As a discipline that exists at the juncture of physics and biology, radiation oncology addresses the therapeutic uses of ionizing radiation alone or in combination with other treatment modalities such as surgery, chemotherapy and targeted therapy and immunotherapy. Furthermore, radiation oncology is concerned with the investigation of the fundamental principles of cancer biology, the biologic interaction of radiation with malignant and normal tissue, and the physical basis of therapeutic radiation.

Radiation oncologists are an integral part of the multidisciplinary management of the cancer patient and must collaborate closely with physicians in related disciplines in the management of the patient.

The objective of the residency program is to educate and train physicians to be skillful in the practice of radiation oncology, and to be caring and compassionate in the treatment of patients. To accomplish this goal, adequate structure, facilities, faculty, patient resources, and an educational environment are provided.

II. Curriculum Goals and Objectives

The objectives of the training program are to educate and train physicians in radiation oncology up to the level of being recognized as a specialist capable of practicing the specialty competently and independently.

Following successful completion of their training, the trainees should have these core competencies:

1. Enough theoretical knowledge and practical skills for the competent, safe, ethical and compassionate practice of radiation oncology.
2. Demonstrate competence in their medical knowledge of the following radiotherapy sciences:
 - a. epidemiology, etiology, pathology and natural history of human neoplasia.
 - b. clinical radiation physics
 - c. radiobiology

- d. medical statistics
 - e. clinical radiation oncology as part of comprehensive management of cancer
 - f. radiation safety procedures
3. Familiarity and skills in the choice of all necessary and available diagnostic aids in the diagnosis and management of cancer.
 4. A capability to manage cancer patients comprehensively including familiarity with the role of surgery, medical oncology and other medical disciplines involved in the management of neoplastic diseases. Also, the complications associated with malignant disease and its treatment, rehabilitation and palliative care and psychosocial aspects
 5. Technical expertise in radiation oncology, knowledge of adverse effects of radiation, and competence of follow up care of irradiated patients.
 6. Demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. They should maintain comprehensive, timely, and legible medical records.
 7. Demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Professionalism is a key factor for resident evaluation, and these competencies must be demonstrated:
 - a. compassion, integrity, and respect for others
 - b. responsiveness to patient needs that supersedes self interest
 - c. respect for patient privacy and autonomy
 8. Capacity to interpret current advances in cancer care and research (clinical, laboratory or basic). Residents are expected to actively involve in the department's research projects.
 9. Sufficient interest, knowledge and skills to contribute to future developments in radiation oncology.

III. Organization of the program

1. National Authority

The Radiation Oncology residency at KHCC is recognized by Jordan Medical Council for Jordanian Board Certification in Radiation Oncology. There are two parts for the board exam; Part I is a written exam testing basic radiotherapeutic sciences and Part II (written and oral) focuses on clinical sciences. Board exams take place twice a year; March and September. Part I is taken after at least one year in the training, and Part II is taken after the fourth (final) year.

2. Requirement for the trainees

The candidate for the postgraduate program in radiation oncology should be a medical graduate from a medical school. Candidate residents must have completed their internship training and hold a valid Jordanian medical Practice license at time of appointment.

3. Candidate enrolment and progress in the residency program

There will be at least one resident per year of the educational program. Academic year starts in July and acceptance to the program is subject to passing the unified KHCC residents acceptance exam with competitive score and undergoing a satisfactory interview by a committee of the program director and faculty ([Appendix I](#)). Candidate residents who are sponsored by foreign institutions and governments will follow specified acceptance criteria as outlined in mutual agreements with KHCC.

As for resident transferring from another Radiation Oncology program, the program director must obtain written or electronic verification of previous educational experiences and a summative competency-based performance evaluation before accepting a transferring resident.

The training program in radiation oncology is 48 months in length. Successful transition from one year to another is subject to the annual exam score and periodic evaluation by staff physicians ([Appendix II](#)).

4. Level of skills

The International Atomic Energy Agency (IAEA) 2009 Syllabus for the Education and Training of Radiation Oncologists recognized three levels of skills that are needed depending on the differences in infrastructure and equipment present in different institutions. *Level I* is related to basic radiotherapy planning by X-ray, 2D manual dose calculations, simple mould room techniques and treatment by a cobalt unit using simple field arrangements. *Level II* is Intermediate level of planning using a simulator with patient contouring or a CT simulator and 2D or 3D plan is created with a treatment planning system. *Level III* is complex treatment planning and is performed by a dedicated CT-simulator and treatment is delivered by a linear accelerator using a multi-leaf collimator (MLC). This is the routine practice at KHCC where these techniques are frequently used: intensity modulated radiation therapy (IMRT), Arc therapy (VMAT), image-guided radiotherapy (IGRT), stereotactic radiosurgery (SRS), adaptive radiotherapy (ART), respiratory gating and three-dimensional (3-D) image-based brachytherapy planning.

5. Faculty

- The Program Director (PD) is responsible for the general administration of the program, the structure and its contents. The PD ensures that the program fulfils the criteria set in this syllabus. The PD should discuss with each individual trainee on a periodic basis his/her progress through the program, according to the evaluations made by the supervisors, the logbook and results of examinations.
- The Radiation Oncology medical staff are involved in the active teaching activities from didactic lectures to supervising seminars and other educational activities. During clinical rotations, Radiation Oncology staff must devote enough time to the teaching program to allow interaction with the trainees to advance their clinical knowledge and develop their skills in radiotherapy planning.
- Medical Physics teaching staff should be responsible for the teaching of basic radiation physics, applied medical radiation physics including treatment planning, elements of dosimetry, quality assurance and radiation protection.
- Radiobiology teaching staff: It is known that radiobiology teaching is challenging due to lack of qualified radiobiologists in institutions. In most part of it, this will be self-learning. At KHCC, every effort will be made to provide sufficient teaching in radiobiology and cancer biology through organized teaching courses and lectures by medical faculty.

6. Educational Program

A. Regularly Scheduled Didactic Sessions

- The KHCC Radiation Oncology Residents Educational series are set of didactic lectures, Quality Assurance (QA) rounds, seminars, journal clubs and treatment planning sessions. that enhance and correspond to the residents' fundamental clinical skills education. These are given by staff Radiation Oncologists, residents and dosimetrists/physicists and all activities are directed to one body cancer site/month ([example in Appendix III](#)).
- Physics and radiation protection lectures.

B. Clinical Experience

- Residents will be assigned to one of clinical rotations every three months. Residents must have responsibility for decision-making and direct patient care in all settings, subject to review and approval by senior-level residents and/or attending physicians, to include the planning of care and the writing of orders, progress notes, and relevant records.
- The ACGME outlined these minimum requirements for training in Radiation Oncology, and at KHCC every effort should be made by residents and faculty to fulfill these requirements:
 - The number of patients treated with external beam irradiation by each resident should approximate 150 per year (determined by the number of patients simulated) with an absolute minimum of 450 over the four years of residency. Only cases for which the resident has primary responsibility performing the simulation and planning must be counted. Residents must treat at least 12 pediatric patients, at least nine of whom have solid tumors
 - Residents must perform at least five interstitial implants and 15 intra-cavitary implants (planning, review of dosimetry, and hands-on participation in a significant portion of implantation procedures).
 - Residents must participate in the treatment planning and administration of stereotactic radiosurgery in at least 10 patients.
- Residents must follow up with irradiated patients, including pediatric patients, on an inpatient or outpatient basis
- Residents must have experience with: lymphomas and leukemias; and gastrointestinal, gynecologic, genitourinary, breast, soft tissue, and bone, skin, head and neck, lung, pediatric, and central nervous system tumors.
- Residents must have experience in the treatment of benign diseases for which radiation is utilized.
- Residents need to document their attendance to the institutional weekly Ground Rounds, Tumor Boards and *Multi-disciplinary Team (MDT)* meetings. Residents should attend National Oncology Conferences whenever possible as trainees' registration fees are usually waved or sponsored by KHCC.

- Residents will have these rotations by the end of the third year and beginning of the fourth year:
 - Two months in Medical and Pediatric Oncology
 - One Month in Diagnostic Radiology, Nuclear Medicine and Pathology

C. Residents' Scholarly Activities

Residents must initiate and participate in ongoing research projects at KHCC. The results of such projects must be suitable for publication in peer-reviewed scholarly journals or for presentation at scientific meetings. Active research is one of the components of trainee evaluation form.

D. On duty schedule

Trainees at Radiation Oncology residency program have no night shifts; however, they will participate in the after-5pm, weekends and Holidays on-call roster. Residents in their last 6 months of training will be excluded from these duty schedules.

7. Documentation of the training experience

These are adopted from the IAEA Syllabus. The training institute should maintain a record of each trainee's clinical rotations, logbook and evaluations. The trainee is in turn responsible to keep a record of his/her clinical training procedures (logbook). This can be extended to a full **portfolio** including five sections:

Section 1: Personal data

This section will include updated curriculum vitae (CV) with details of the local training programs being followed, including visits to other institutes and registration numbers with the national licensing authority.

Section 2: Scientific training documentation and other courses

This section will include details of teaching courses and programs attended within the institute or elsewhere.

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 trainee ([Appendix IV](#)).

Section 4: Record of formal presentations by the trainee

This section could include a copy of any handouts, overheads, copies of slides/power point presentations and written audit reports prepared for meetings within the department.

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 trainee.

8. Evaluation of Trainees

Trainees performance will be evaluated quarterly by their faculty by the end of each clinical rotation ([Appendix II](#)). Trainee evaluation records are permanently maintained by KHCC Graduate Medical Education (GME) office. These evaluations are used to calculate final yearly score along with annual exams for successful transition for the following academic year. Residents performance during their clinical rotations as well as the quality of their presentations at educational activities will be evaluated. In addition, at the end of each academic year, the other non-MD professional groups within the department are asked to evaluate the residents. The Program Director should meet periodically with the trainees to discuss the evaluations and logbook and provide feedback.

IV. Residents Tasks

The below summary is considered as a job description for Radiation Oncology residents during their clinical rotations:

- Residents are responsible for seeing all new patients referred to their service and will conduct complete history and physical examinations, review the pathology and diagnostic imaging studies, obtain information from referring physicians, formulate a treatment plan, and present all of this information to the attending physicians who, in turn, review it in detail. The residents, with the attendings, obtain informed consents from the patients. Residents then write a note in the patient chart to be co-signed by their attending. Residents need to obtain and follow on any additional required investigation.
- When the therapeutic strategy includes radiation therapy, patients are normally scheduled for simulation and treatment planning. Residents are responsible for completing patients' data in radiotherapy electronic chart (MOSAIQ) including cancer type and stage, simulation instructions and prescription.
- Following the simulation, residents start with radiotherapy planning and review the contours and beam arrangements with their attending before submitting the case for dosimetry. Residents (along with their attending) approve the radiotherapy plan afterwards.
- The residents are responsible, along with the oncology nurses and attendings, for monitoring the day-to-day progress of the patients. On a weekly basis (or more often when necessary), the residents and the attendings examine each patient and review his/her progress and document in the patient chart (Floor Clinic). Upon completion of treatment, the residents write a treatment summary in the patient chart and schedule follow up visits.
- Residents are actively involved in the follow-up clinics of their service, providing important exposure to the natural history of various malignancies, response to treatment, patterns of relapse, salvage treatment and normal tissue effects. Residents will often see the same patients when they return to a particular service in subsequent years, providing the residents with some degree of patient continuity during the four years in our program. In the follow-up clinics, residents present each patient evaluated to the attending physicians, who also see the patients. Residents need to document patients' symptoms, disease status, relevant investigations findings and physical exam findings including the presence of any late radiation toxicities.
- Departmental QA rounds (attended by trainees, faculty physicians and physicists): Residents need to prepare a summary of all the radical cases that they have seen and participated in the planning process to be presented at these twice weekly meetings. The resident is expected to know the clinical information of the specific patients presented, and to explain and defend his/her therapeutic plans. Faculty and other residents participate by asking questions regarding the plans presented.
- Residents and their attending perform the weekly chart rounds; reviewing on-treatment patients charts for completion and any treatment interruptions and reviewing the portal/CBCT images.

- Residents need to document their attendance to the institutional weekly Ground Rounds, Tumor Boards and the *Multi-disciplinary Team (MDT)* meetings relevant to their service.
- Residents on-call duties and participation in other educational activities are outlined in section [III.6].

V. Core Curriculum

Residents are expected to acquire solid knowledge of basic and clinical sciences during the four years training period.

A. Basic Sciences Curriculum

I. *General Knowledge*

1. Epidemiology of cancer
2. Cancer prevention, screening and early detection
3. Tumor classification and staging systems
4. Principles of radiation protection and shielding

II. *Anatomy*

Knowledge of cross-sectional anatomy of the human body is essential for radiotherapy planning.

III. *Pathology*

IV. *Statistics and Clinical Research*

1. Study design
2. Definitions of statistical terms
3. General interpretation & analysis
4. Survival curves
5. Specificity/sensitivity
6. Tests of significance
7. Phase III studies (randomized)
8. Retrospective trials/historical controls
9. Phase I & II studies (nonrandomized case control studies)
10. Systematic Review and meta-analysis

V. *Physics*

1. Atomic and nuclear structure
2. Radioactivity, radioisotopes and decay
3. Properties of particle and electromagnetic radiation
4. X ray tube and production of photons and electrons
5. Linear accelerators

6. Radiation interactions
7. Radiation Quantities and Units
8. Radiation measurements and calibration
9. Radiation beam quality and dose
10. Photons and x-ray characteristics of dosimetry
11. Electron beam characteristics & planning
12. External beam QA
13. Brachytherapy
14. Prescribing, Reporting, and Evaluating Radiotherapy Treatment Plans - ICRU Reports 50, 62, 71 and 83
15. IMRT /IGRT
16. Simulation, Immobilization & verification for 3D-CRT
17. Imaging for radiation oncology; use of imaging for treatment planning and delivery (CT-sim, MRI, PET, US, Portal films, CBCT)
18. Special irradiation techniques: Total body irradiation (TBI), Stereotactic radiosurgery (SRS), Total skin electron irradiation (TSEI)
19. Particle therapy (protons, heavy ions)

VI. Cell Biology and Radiobiology

1. Interaction of Radiation with Biological Systems
2. Molecular Mechanisms of DNA Damage
3. Molecular Mechanisms of DNA Repair
4. Chromosome and Chromatid Damage
5. Mechanisms of Cell Death
6. Cell and Tissue Survival Assays
7. Models of Cell Survival
8. Modifiers of Cell Survival: LET and RBE
9. Modifiers of Cell Survival: Oxygen Effect
10. Modifiers of Cell Survival: Repair
11. Tumor Microenvironment
12. Cell and Tissue Kinetics
13. Molecular Signaling
14. Cancer Biology
15. Total Body Irradiation
16. Clinically Relevant Normal Tissue Responses to Radiation
17. Mechanisms of Normal Tissue Radiation Responses
18. Therapeutic Ratio
19. Time, Dose, Fractionation
20. Radiobiological aspects of alternative dose delivery systems (Proton, high LET, SRS, IMRT)
21. Chemotherapeutic agents and radiation therapy
22. Radiosensitizers and Radioprotectors
23. Hyperthermia
24. Radiation Carcinogenesis
25. Heritable Effects of Radiation
26. Teratogenesis: Effects on the Embryo and Fetus
27. Radiation Protection

B. Clinical Curriculum

As a responsible and independent member of a multidisciplinary team a specialist in radiation oncology should be able to:

- Recognize symptoms and signs of cancer.
- Make a diagnostic plan for suspected tumors or metastases and perform staging and classification of manifested tumors.
- Perform a prognostic assessment, define the treatment aim, choose the radiation modality (or interdisciplinary modality), plan and apply optimal radiation therapy and carry out the follow-up during and after treatment.
- Apply radiobiological skills in clinical practice.
- Diagnose, score and treat side-effects of radiation therapy, assess the impact of radiation oncology on quality of life.
- Communicate adequately and accurately with cancer patients and their families. Manage common psychological reactions to crises and to the final stage of life.
- Perform supportive care/symptomatic treatment and terminal care.
- Recognize own limitations and refer to appropriate allied staff and colleagues when appropriate and available (radiologists, medical oncologists, specialists in palliative care, pain specialists).

During the training period each trainee should acquire knowledge and skills in the management of below listed topics:

I. Bone & Soft Tissue

1. Workup, pathology and staging
2. Bone tumors
3. Soft tissue sarcomas
4. Bone metastasis from other primary and its management including SBRT
5. Toxicity (acute and late) and its management

II. Breast

1. Anatomy (nodes or drainage), Risk factors + genetics, Mammography screening, breast cancer staging, gene expression profiling and biomarkers
2. Early-stage breast cancer
3. Ductal carcinoma in situ (DCIS) & lobular carcinoma in situ (LCIS)
4. Locally advanced breast cancer
5. Inflammatory breast cancer
6. Pathological CR, systemic treatment (chemotherapy, hormonal therapy and targeted therapy)
7. Recurrent and metastatic breast cancer
8. Hypofractionated /APBI
9. breast brachytherapy/APBI
10. Post-mastectomy radiation therapy
11. Toxicity (acute and late) and its management

- III. CNS/Eye
 - 1. Anatomy, genetics, imaging, cancer staging and OAR tolerances
 - 2. Low- and high-grade gliomas
 - 3. Meningioma
 - 4. Intracranial Ependymoma
 - 5. CNS lymphoma
 - 6. Pituitary and Craniopharyngioma
 - 7. Medulloblastoma and Supratentorial PNET
 - 8. Primary Spinal Cord Tumor
 - 9. Brain/ leptomeningeal metastasis and palliative management
 - 10. Stereotactic Radiosurgery (SRS)
 - 11. Eye and Orbital diseases [lymphoma, melanoma, benign conditions]
 - 12. Toxicity (acute and late) and its management

- IV. Gastrointestinal (GI) Tract
 - 1. Anatomy, genetics, risk factors, imaging, cancer staging and OAR tolerances
 - 2. Esophagus
 - 3. Stomach
 - 4. Pancreas
 - 5. Hepatobiliary cancers, including liver SBRT
 - 6. Colon and rectum
 - 7. Anal canal
 - 8. Toxicity (acute and late) and its management

- V. Genitourinary (GU) Tract
 - 1. Anatomy, genetics, risk factors, imaging, cancer staging and OAR tolerances
 - 2. Renal cell cancer
 - 3. Bladder cancer
 - 4. Prostate cancer, including brachytherapy
 - 5. Penis cancer
 - 6. Testicular cancers
 - 7. Toxicity (acute and late) and its management

- VI. Gynecology
 - 1. Anatomy, genetics, risk factors, imaging, cancer staging and OAR tolerances
 - 2. Endometrium & uterus
 - 3. Vulva, urethra and vagina
 - 4. Cervix
 - 5. Ovary and fallopian tubes
 - 6. Brachytherapy for gynecological cancers, 2D and 3D including interstitial
 - 7. Toxicity (acute and late) and its management

- VII. Head and Neck
 - 1. Anatomy, genetics, risk factors, imaging, cancer staging and OAR tolerances
 - 2. Nasopharynx
 - 3. Nasal cavity and paranasal sinuses
 - 4. Oropharynx
 - 5. Oral cavity and lip

6. Larynx and hypopharynx
7. Thyroid and Salivary glands
8. Unknown primary
9. Toxicity (acute and late) and its management

VIII. Leukemia, Lymphoma and Myeloma

1. Anatomy, genetics, risk factors, imaging, staging and OAR tolerances
2. Role of radiotherapy in Leukemia, including TBI
3. Hodgkin lymphoma
4. Non-Hodgkin lymphoma
5. Cutaneous lymphoma
6. Multiple Myeloma and Plasmacytoma
7. Toxicity (acute and late) and its management

IX. Pediatrics

1. Anatomy, genetics, risk factors, imaging, staging and OAR tolerances
2. CNS tumors
3. Leukemia
4. Retinoblastoma
5. Lymphoma
6. Wilms
7. Neuroblastoma
8. Rhabdomyosarcomas
9. Ewing's
10. Toxicity (acute and late) and its management, secondary cancers

X. Skin

1. Anatomy, genetics, risk factors, imaging and staging
2. Melanoma
3. Non-Melanoma skin carcinomas

XI. Thorax

1. Anatomy, genetics, risk factors, imaging, staging and OAR tolerances
2. Small Cell Lung Cancers, including Prophylactic Cranial Irradiation
3. Non- Small Cell Lung Cancers
4. Mesothelioma and Thymic tumors
5. Toxicity (acute and late) and its management

C. Introductory Radiation Oncology Curriculum (IROC)

Starting in 2020, all new residents will be taught this curriculum in the first two weeks of the training during the orientation period. The curriculum is designed to provide the basic components of clinical practice from consultation to simulation, contouring to treatment planning, and QA to daily treatment delivery. It is composed of 7 interactive sessions, each ranging from 30 minutes to 2.5 hours in length, and each focusing on a unique aspect of the radiation

oncology workflow. The sessions can be administered by a mix of attending physicians, residents, dosimetrists, and physicists as appropriate for each lecture.

Total Running Time: 9 hours

Session 1: Introduction to Radiation Oncology (1 hour)

Session 2: CT simulation (2 hours)

Session 3: Contouring (2.5 hours)

Session 4: Treatment Planning and Evaluation (2 hours)

Session 5: Physics Quality Assurance (30 minutes)

Session 6: Patient Set-up and Verification (30 minutes)

Session 7: Radiation Oncology Emergencies (1 hour)

IROC materials can be downloaded from <https://voices.uchicago.edu/roecsg/iroc/>

VI. Curriculum Goals by Year of Training

A. *First Year Residents*

During the first month of their rotation, residents will benefit from a focused orientation which will include: basic radiation safety, multidisciplinary patient care, treatment planning, clinic structure, physics, radiobiology, simulation, port films and equipment at the primary institution. Following the one-month orientation period, eleven months will be dedicated to clinical rotations and will be weighted toward services which provide a wide spectrum of basic oncology problems. During the clinical rotations, residents will perform initial history and physical examinations, review radiographic films and pathology, and formulate treatment plans. The residents will participate in the simulation, treatment planning and dosimetry and treatment of their patients. In addition, residents will participate in follow-up examinations after treatment is completed. During each clinical rotation the residents will be supervised and instructed on a one-to-one basis by a faculty member who is responsible for both resident teaching and evaluation of resident performance during that rotation.

Objectives for Satisfactory Completion of First Year:

Basic:

1. Knowledge of procedures and policies for residents in radiation oncology training.
2. Attendance of lecture series in medical physics and other institutional and departmental educational activities.
3. Satisfactory performance review by Program Director.

Clinical:

Satisfactory completion and evaluations on clinical rotations at KHCC geared towards more general and basic principles of Radiation Oncology, including imaging, staging, patient work-up and multi-modality treatment approaches.

1. Ability to present summaries of service patients during chart rounds or other conferences.

2. Ability to identify basic relevant clinical data required to evaluate and manage general oncology patients.
3. Completion of electronic log files demonstrating care of approximately 150 cases/year focused mainly on general oncologic entities.
4. Beginning of basic understanding of quality assurance processes as they apply to radiation oncology.

Academic:

1. Satisfactory development of presentation skills at departmental educational activities.
2. Facile with use of medical informatics tools including departmental and hospital wide information systems.
3. Begin self-learning with textbook reading supplemented with classic literature and important clinical trials.
4. Acquire basic knowledge of clinical radiotherapy physics.
5. Acquire basic knowledge of radiobiologic principles as they apply to clinical situations.
6. Presentation of resident seminar/journal club.
7. Demonstrate beginning ability to critically evaluate and review medical literature relevant to patient care and conference discussions.

B. *Second Year Residents*

The clinical rotations during the second year are intended to foster more in-depth learning by focusing on site-specific services which interact with the referral base, and other oncology and surgical specialties practice. During the second year, each resident will increase their knowledge base in Medical Oncology, Pathology and Radiology, and it is expected that residents will take an increasingly active role in diagnosis, recommending treatment, performing simulations and monitoring treatments. During the clinical rotation the residents will be supervised and instructed on a one-to-one basis by a faculty member who is responsible for both resident teaching and evaluation of resident performance during that rotation.

Objectives for Satisfactory Completion of Second Year:

Basic:

1. Attendance of lecture series in medical physics and other institutional and departmental educational activities.
2. Satisfactory performance review by Program Director

Clinical:

1. Ability to handle on-call emergency situations under faculty supervision.
2. Mastery of basic clinical radiotherapy with a knowledge base commensurate with level of training.
3. Completion of log files demonstrating care of approximately 150 cases per year focused on general and moderately complex oncologic entities.
4. Successfully complete rotations on more complex services than first year residents as demonstrated by satisfactory evaluations by faculty.

5. Assume more responsibility on more general radiotherapy services as demonstrated by satisfactory evaluations.
6. Demonstrate an increased understanding of technical aspects of radiotherapy by participating fully in the treatment planning processes.
7. Basic understanding of quality assurance processes as they apply to radiation oncology.
8. Basic understanding of brachytherapy procedures.

Academic:

1. Demonstrate ability to self-learn by identifying and citing pertinent primary literature in common oncologic diseases.
2. Demonstrate ability to critically evaluate and review medical literature.
3. Presentation of resident seminars with satisfactory evaluations from resident and faculty attendees.
4. Complete research project(s), write and submit abstract(s) and/or complete manuscript(s) for publication with faculty supervision.

C.

Third Year Residents

The clinical rotations will be designed to increase the level of focus and intensity of the learning experience for the residents. Residents will be expected to build on the knowledge and experience of the preceding years, to the point that they will have the knowledge to propose and carry out treatment of the various disease sites. During the clinical rotation, the residents will be supervised and instructed on a one-to-one basis by a faculty member who is responsible for both resident teaching and evaluation of resident performance during that rotation. Residents will be required to complete a two-months in Medical and Pediatric Oncology, and one-month in Diagnostic Radiology, Nuclear Medicine and Pathology.

Senior residents are expected to take on a substantial teaching and mentoring role within the training program, helping to organize and lead discussions in the various conferences.

Objectives for Satisfactory Completion of Third Year:

Basic:

1. Attend lecture series, with a further increased teaching role.
2. Give thorough presentations on general or focused oncologic topics.
3. Increase understanding of complex treatment planning, such as 3D conformal and IMRT/VMAT techniques and gain experience in clinical brachytherapy and treatment planning.
4. Satisfactory performance review by Program Director.

Clinical:

1. Ability to handle on-call and/or emergent situations under faculty supervision in a more independent manner.
2. Ability to manage general clinical situations on an independent basis.
3. Participate in rotations with a variety of complexities, with an emphasis on problem solving and decision making. Residents at this level should be able to assess a patient situation, determine the

appropriate course of treatment and develop and implement the treatment plan, with attending supervision.

4. Completion of log files demonstrating care of approximately 150 cases per-year focused on moderately complex oncologic entities.
5. Continue experience in brachytherapy.
6. Continue to develop facility with more complicated treatments including stereotactic radiotherapy, 3D treatment planning, IMRT, and treatment planning for brachytherapy.
7. Beginning ability to formulate valid critique of treatment and treatment plans for quality assurance purposes.

Academic:

1. Self-learning should focus on developing in-depth understanding of pertinent clinical, biological and technical literature.
2. Be conversant in important clinical studies and understand their application to treatment decision-making.
3. Presentation of lectures with satisfactory evaluations from resident and faculty attendees.
4. Complete research project(s), write and submit abstract(s) and/or complete manuscript(s) for publication with faculty supervision.

D. *Fourth Year Residents*

The clinic rotations will be designed at a high level of learning for the residents. During the clinical rotation the residents will be supervised and instructed on a one-to-one basis by a faculty member who is responsible for both resident teaching and evaluation of resident performance during that rotation. The residents will have had sufficient training and exposure to perform at an independent level and carry out treatment of any disease site. Residents should be serving as mentors to junior level residents, sharing experience and knowledge and assisting residents to achieve individual learning curves. Senior residents are expected to take on a substantial teaching and mentoring role within the training program, helping to organize and lead discussions in the various conferences. Fourth year residents are additionally each designated and serve as '*chief resident*'. The chief resident performs academic and administrative responsibilities, which include organization of the educational conference schedule, assignment of clinical rotations and performance of other administrative matters.

Residents will be required to continue to focus on a clinical research project during their final year of training. The faculty member assigned to mentor the resident in their research project will continue to work with the resident to help them achieve their research goals of completing the production of abstracts and manuscripts for submission to peer-reviewed journals or presentations at regional and national scientific meetings.

Objectives for Satisfactory Completion of Fourth Year:

Basic:

1. Attend lecture series, acting as leader or moderator along with faculty, taking an active teaching role with students and fellow residents.

2. Facilitate thorough presentations at a level of quality appropriate for meetings or multidisciplinary audiences.
3. Satisfactory performance review by program director.

Clinical:

1. Ability to handle on-call situations under faculty supervision.
2. Ability to manage moderately complex clinical situations on an independent basis.
3. Successful completion of required clinical rotations while continuing to develop independent skills in clinical decision-making and treatment planning.
4. Demonstrate competency to act as a general practitioner in Radiation Oncology.
5. Completion of log files demonstrating care of approximately 150 cases per year focused on more complex oncologic entities.
6. Sufficient experience in the delivery of brachytherapy.
7. Experience and facility with complex treatments including stereotactic radiotherapy, 3D treatment planning and IMRT/VMAT to assure the resident can independently plan and perform these procedures.
8. Ability to formulate valid critique of treatment and treatment plans for quality assurance purposes.

Academic:

1. Self-learning should focus on areas of interest, areas where experience may be lacking with more in depth reading on all aspects of academic oncology.
2. Complete research project(s), write and submit abstract(s) and/or complete manuscript(s) for publication with faculty supervision.

VII. Clinical Research

The office of scientific affairs and research at KHCC is providing an annual training course for radiation oncology residents in research methodology and study design.

This 18 weeks research training aims to equip radiation residents with the basic knowledge and fundamental skills to initiate and conduct rigorous and original clinical research projects.

Residents in this training must design a clinical research project that will be reviewed by instructors and orally presented at the end of the course.

Moreover, during their rotations, residents are required to develop a research idea and complete a research project under supervision of a staff member, the research outcome will be evaluated and added to their yearly evaluation.

VIII. Suggested Textbooks and Educational Resources

These books are available in a shared folder in pdf format, and residents can read from other resources and seek the latest editions of these textbooks.

A. Physics

1. The Physics of Radiation Therapy, 5th edition, Faiz M. Khan, Williams & Wilkins 2014

B. Radiobiology

1. Radiobiology for the Radiologist, 6th edition, Eric Hall, Lippincott Williams & Wilkins 2006

C. Clinical *(also include sections on physics, radiobiology and treatment planning)*

1. Handbook of Evidence-Based Radiation Oncology, 3rd edition, Eric Hansen and Mack Roach, Springer 2018
2. Gunderson and Tepper's Clinical Radiation Oncology, 5th edition, Tepper, Elsevier 2020
3. Pocket Radiation Oncology, 1st edition, Tang and Farooqi, Wolters Kluwer 2019
4. Fundamentals of Radiation Oncology: Physical, Biological, and Clinical Aspects, 3rd edition, Murshed, Academic Press 2019
5. Hoffman and Abeloff's Hematology-Oncology Review, 1st edition, Isaac, Elsevier 2018
6. Landmark Trials in Oncology, 1st edition, Yajnik, Springer 2019

D. Treatment planning

1. Radiation Therapy Planning, 2nd edition, Bentel, McGraw-Hill, Ohio 1995 *(for 2D planning)*
2. Treatment Planning in Radiation Oncology, 2nd edition, Faiz M. Khan, Lippincott Williams & Wilkins 2007
3. Radiotherapy in Practice External Beam Therapy, 3rd edition, Hoskin, Oxford 2019

E. Contouring Resources

- Anatomy:

1. Headneckbrainspine.com (Open access)
2. E-anatomy: <https://www.imaios.com/en/e-Anatomy> (subscription)

- Contouring guides:

3. RTOG atlases: <https://www.rtog.org/CoreLab/ContouringAtlases.aspx>
4. Prostadoodle: www.Prostadoodle.com
5. E-contour: <https://econtour.org> (Open access)

F. Websites: These international societies websites have extensive library of educational materials and learning modules:

1. IAEA International Atomic Energy Agency
<http://www.iaea.org/>
2. ESTRO European Society for Therapeutic Radiology and Oncology
<http://www.estro.org>
3. ASTRO American Society for Oncology
<http://www.astro.org/>
4. ABS American Brachytherapy Society
<http://www.americanbrachytherapy.org/>
5. ASCO American Society of Clinical Oncology
<http://www.asco.org/>

(Appendix I)


The below table is from the Residents Application Evaluation Form demonstrating its components and their weight towards the final score.

Evaluation Area	Score
Test score	/ 75
Interview score	/ 15
Medical School Score: <i>Excellent</i> = 10 marks <i>Very Good</i> = 8 marks <i>Good</i> = 6 marks <i>Satisfactory</i> = 4 marks	/10
Total Score	/ 100

(Appendix II)

For successful transition from one year to the next year, the resident must score at least 60%.

Annual exam (written)	Annual exam (oral)	Commulative evaluations	Total
----/60	----/20	----/20	----/100



مركز الحسين للسرطان
KING HUSSEIN CANCER CENTER

Academic Affairs Office
Physician Education Center
Physician Trainee General Evaluation Form

Attachment no.: POLAAO-06/Attach. A/R0
 Effective date: 17/3/2012

Department of

Trainee's Name:	Resident/Fellow:	
Attending Name:	Rotation Period:	
Evaluation Date:		

Evaluation Scale:
 NA: Not applicable; 1-4: Unsatisfactory, 5-6: Satisfactory, 7-8: Good, 9-10: Outstanding

Area	Score	Comments
1. Patient Care / Clinical Skills: (10)		
<ul style="list-style-type: none"> - History taking / Physical exam - Analyzes available information to make diagnostic and screening studies - Carries out management plan - Performs essential procedures - Educates patients and families - Demonstrates sound clinical judgment - Maintain comprehensive, accurate and timely admission and follow up notes 		
2. Medical Knowledge: (10)		
<ul style="list-style-type: none"> - Possesses appropriate fund of knowledge - Applies knowledge to management plan 		
3. Interpersonal & Communication Skills: (10)		
<ul style="list-style-type: none"> - Interacts well with staff, faculty & colleagues - Demonstrates compassion for patients and their families - Presents patients effectively and concisely - Works effectively as member or leader of health care team - Is able to act as consultant to other health professionals 		
4. Academic Performance: (10)		
<ul style="list-style-type: none"> - Actively involved in departmental and Center Activities - Actively involved in Research - Involved in teaching Junior Staff 		
5. Professionalism: (10)		
<ul style="list-style-type: none"> - Punctual, works hard and helps others - Fulfills assigned clinical and on call responsibilities (Reliable) - Demonstrates dependability and commitment - Demonstrates respect, compassion and honesty - Adherent to center's policies and procedures 		
TOTAL:	=	%

Attending :	Date:
Program Director :	Date:
Trainee :	Date:
Trainee's Comments: _____	

(Appendix III)

Radiation Oncology Residents' Educational Series 2017-2018

January 2018 Lymphoma, Sarcoma, Ocular			
Residents' Sunday (1-2pm) activities (case discussions, journal clubs and lectures)	Faculty lectures Tuesdays (8-9am)	Residents' Wednesdays (8-9am) landmark trials and Journal news presentations	Faculty- Residents and Dosimetry- Residents interactive planning sessions Wednesdays (1-2pm)
		Wednesday 3 Title: TBA By: xxxx	
Sunday 7 Title: Journal club By: xxxx	Tuesday 9 Title: Lymphoma I By: xxxx	Wednesday 10 Title: TBA By: xxxx	Wednesday 10 Lymphoma planning (TVD/OAR) By: xxxx
Sunday 14 Title: Case presentation By: xxxx	Tuesday 16 Title: Lymphoma II By: xxxx	Wednesday 17 Title: TBA By: xxxx	Wednesday 17 Lymphoma planning/ Dosimetry By: xxxx
Sunday 21 Title: Lecture By: xxxx	Tuesday 23 Title: Ocular tumors By: xxxx	Wednesday 24 Title: TBA By: xxxx	Wednesday 24 Sarcoma planning (TVD/OAR) By: xxxx
Sunday 28 Title: Lecture By: xxxx	Tuesday 30 Title: Sarcoma By: xxxx	Wednesday 31 Title: TBA By: xxxx	Wednesday 31 Sarcoma planning/ Dosimetry By: xxxx

(Appendix IV)

**King Hussein Cancer Center
Radiation Oncology Department
Resident's log book**

Resident name:

Level:

Academic year:

Rotation:

Attending physician(s):

#	Date	MRN	Diagnosis & case summary	R/P*	Planning	
					TVD	OAR

Total yearly # of cases = (R= P=)

Faculty Remarks

*R= Radical, P=Palliative