RADIOLOGY
A Guide to the Four Year Specialty Training Program
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Introduction

The aim of the Radiology Residency Program is to develop within the resident the interpretive, interpersonal and procedural skills necessary to perform as a competent radiologist and to encourage critical thinking applied to medical knowledge to allow development of a life-long process for improvement of radiologic practices.

Diagnostic Radiology is a specialty concerned with the use of imaging techniques in the study, diagnosis and treatment of disease, furthermore with the principles of radiation protection and its physical, biological and medical basic sciences. Imaging techniques include all different plain radiological modalities, cross sectional imaging -computed tomography (CT), magnetic resonance techniques (MRI), and ultrasound-, interventional radiology and Radionuclide.

The mission of the program is to develop and educate specialists in Diagnostic Radiology, who are highly capable and confident in managing the complete spectrum of Diagnostic Radiology. As well, the program strives to develop individuals, who practice the profession humanely, with the highest of ethical standard and integrity.

The principles of evidence based medicine, self-evaluation and lifelong learning skills will be adhered to. Ultimately the goal is, to produce individuals, who will contribute to the community in providing excellent clinical care as well as areas of education and research.

General Objectives

- On completion of the educational program, the graduate physician will be competent to function as a specialist in Diagnostic Radiology. This requires the physician to have the ability to supervise, advise on and perform imaging procedures to such a level of competence, and across a broad range of medical practice, as to function as a specialist to referring family physicians and specialists.

- Communication skills, knowledge, and technical skills are the three pillars on which a radiological career is built, and all are dependent on the acquisition of an attitude to the practice of medicine which recognizes both the need to establish a habit of continuous learning and a recognition of the importance of promoting a team approach to the provision of imaging services.

- Residents must demonstrate the knowledge, skills and attitudes relating to gender, culture and ethnicity pertinent to Diagnostic Radiology. In addition, all residents must demonstrate an ability to incorporate gender, cultural and ethnic perspectives in research methodology, data presentation and analysis.
Program Administrators

Our Program Administrators in partnership with an expert team of supervisors & faculty steer the Radiology Program towards the zenith of quality Residency training education offered in Dubai.

Under their expert care, your training journey is guaranteed to be an enlightening experience.

Dr. Paul Emmanuel Rwamwamba Businge
PROGRAM DIRECTOR
Consultant – Rashid Hospital

Dr. Samar Mohamed El Maadawy
PROGRAM CO-DIRECTOR
Consultant – Latifa Hospital

Dr. Alia Ahmad AlSayegh
PROGRAM CO-DIRECTOR
Specialist Registrar – Dubai Hospital

Dr. Ebrahim Hasan Ali Mohamed
PROGRAM CO-DIRECTOR
Consultant – Rashid Hospital
Competencies

At the completion of training, Resident will have acquired various competencies and will function effectively as:

**Medical Expert/Clinical Decision-Maker**
- Understanding of the nature of formation of all types of radiological images, including physical and technical aspects, patient positioning, different contrast media.
- Knowledge of the theoretical, practical and legal aspects of radiation protection, including alternative imaging techniques and their possible harmful effects.
- Knowledge of human anatomy at all ages, plain & cross sectional/multi-planner, with emphasis on radiological applications
- Knowledge of all aspects of clinical radiology, including understanding of pathology of diseases, appropriate application of imaging to patients, factors affecting interpretation and differential diagnosis, importance of informed consent, complications such as contrast media side effects and adverse reactions.
- Understanding of fundamentals of quality assurance in radiology, epidemiology, biostatistics & decision analysis.
- Competence in manual and procedural skills and in diagnostic and interpretive skills.
- Demonstration of the ability to manage the patient independently during a procedure, in close association with a specialist or another physician who has referred the patient. The radiologist should know when the patient’s best interests are served by discontinuing a procedure, or referring the patient to another specialist.
- Understanding the acceptable and expected results of investigations and/or interventional procedures, as well as unacceptable & unexpected results. This must include knowledge of and ability to manage radiological complications effectively.
- Understanding of the appropriate follow-up care of patients who have received investigations and/or interventional therapy.
- Understanding of a proper radiology report structure.
- Competence in effective consultation, conduct of interdisciplinary radiological-clinical conferences, and the ability to present scholarly material and prepare and lead case discussions.

**Communicator**
- Ability to produce a radiological report, which will describe the imaging findings, most likely differential diagnoses in order of frequency, and, when indicated, recommend further testing and/or management.
- Understanding of the importance of communication with referring physicians, including an understanding of when the results of an investigation or procedure should be urgently communicated.
- Effective communication with patients and their families and a compassionate interest in them.
- Recognition of the physical and psychological needs of the patient and their families undergoing radiological investigations and/or treatment, including the needs of culture, race and gender.

**Collaborator**
- Ability to function as a member of a multi-disciplinary health care team in the optimal practice of radiology.

**Manager**
- Ability to prioritize and effectively execute tasks through team work with colleagues and make systematic and rational decision when allocating health care resources.
- Competent in computer science as it pertains to the practice of radiology.

**Health Advocate**
- Communicating the benefits and risks of radiological investigation & treatment including population screening.
- Recognition when radiological investigation or treatment would be detrimental to the health of a patient.
- Education and advice on the use and misuse of radiological imaging.

**Scholarship**
- Competence in evaluation of the medical literature.
- Ability to be an effective teacher of radiology to medical students, residents, technologists & clinical colleagues.
- Ability to conduct a radiology research project, which may include quality assurance.
- Appreciation of the important role that basic and clinical research plays in the critical analysis of current scientific developments related to radiology.

**Professionalism**
- Ability of accurate assessment of one’s own performance, strengths and weaknesses.
- Understanding of the ethical and medico-legal requirements of radiologists.
Program Structure

The Radiology Residency training is a four year training program.

The first year comprises of lectures, enabling the Resident to familiarize with the principles of the basic sciences in Medical Imaging, which include Physics in Medical Imaging, Radiation Protection, Radiological Anatomy, Radiological technique & Radiographic positioning, Contrast media and Radionuclide & Radionuclide Imaging. Also it will include clinical rotations for radiological modality-based training.

Modality Training: YEAR 1

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain Radiography</td>
<td>3 Months</td>
</tr>
<tr>
<td>Fluoroscopy Contrast Studies + Intravenous Urography</td>
<td>2 Months</td>
</tr>
<tr>
<td>Ultrasound (including Doppler)</td>
<td>2 Months</td>
</tr>
<tr>
<td>Computerized Tomography (CT) Imaging</td>
<td>1 Month</td>
</tr>
<tr>
<td>Magnetic Resonance (MR) Imaging</td>
<td>1 Month</td>
</tr>
<tr>
<td>Digital Subtraction Angiography (DSA) including diagnostic &amp; therapeutic procedures</td>
<td>1 Month</td>
</tr>
<tr>
<td>Nuclear Medicine Imaging</td>
<td>1 Month</td>
</tr>
</tbody>
</table>

Physics Course

An introductory course on basic radiation physics and radiation safety relevant to clinical radiology is provided during the first three months of training. 35 hours of formal tuition will be delivered, including the current ionizing radiation regulations related to ionizing radiation, given by medical physicists. Candidates are expected to supplement the study by a substantial amount of self-directed learning. Topics covered in the course:
- The fundamental physics of matter and radiation
- Practical radiation protection
- International and UAE Federal Radiation Protection recommendations.
- The physics of other diagnostic imaging modalities such as Ultrasound & MRI, as well as physics of radionuclide and Radionuclide imaging.

Skills & Competencies during the first year:
- Radiological Anatomy, Radiological techniques and procedures - Residents must obtain a sound understanding of Radiological Anatomy and begin acquiring some of the practical skills in Radiological techniques & procedures.
- Radiographic positioning - In the case of Plain radiography, residents should become familiar with the various radiographic techniques even if they do not take the radiographs personally.
- In the first year of training the resident must begin to acquire some of the core interpretation, reporting and Communication skills. This will include discussing the management of patients with clinicians before and after a procedure has been performed. It will also include the discussion of procedures and their possible complications with patients.
- Interpret and formally report the following under the supervision of the attending Radiologist.
  - Core procedures and techniques performed by the resident during his assigned rotation.
  - Selection of in-patient and out-patient radiographs

By the end of the first year residents should:
- Feel confident in their choice of clinical radiology as a career
- Have mastered the basic radiation physics and radiation safety required in clinical radiology.
- Be familiar with the concepts and terminology of diagnostic and interventional radiology.
- Understand the role and usefulness of the common diagnostic and interventional techniques in all age groups.
- Understand the responsibility of Radiologists to patients including the legal framework and the need of an informed consent.
- Familiarity with various contrast media, drugs including administration of sedatives & monitoring in day to day radiological practice, indications, contraindications, doses (adult and pediatric) and the management of reactions and complications.
- Be competent in cardiopulmonary resuscitation.
- Understand the principles of radiation protection and be familiar with the legal framework for protection against ionizing radiation. Residents should also be able to demonstrate that they are capable of safe radiological practice.
- Be familiar with safety requirements for imaging with ionizing & non-ionizing radiation.
- Have a sound understanding of basic radiological and radiographic procedures
- Have developed, under supervision, some basic reporting skills.
- Have mastered and been assessed in basic communication skills and relationships with patients, especially issues around respecting confidentiality and obtaining consent.
Generic competencies Residents are expected to master within scope of this period:

Core knowledge
- Secure knowledge of the current legislation regarding radiation protection.
- Able to offer advice as to the appropriate examination to perform in different clinical situations
- Infection control, child protection, nutrition, sedation and other generic issues that could apply to radiological interpretation and procedures.
- Participation in clinic-radiological/multidisciplinary meetings.

Core skills
- Participation in reporting plain radiographs which are taken during the general throughput of the normal working day of a department of clinical radiology
- Performing any routine radiological procedure that might be booked during a normal working day
- Performing and reporting on-call investigations appropriate to the level of training with the appropriate level of supervision
- Attendance and conducting clinic-radiological conferences and multidisciplinary meetings
- Competence at reviewing studies on a workstation and familiarity with digital image manipulation and post-processing
- Provision of a good standard of practice and care, treatment in emergencies
- Writing reports, giving evidence and signing documents
- Working with colleagues:
  - Treating colleagues fairly
  - Working in teams
  - Arranging cover
  - Taking up appointments
  - Sharing information with colleagues
- Relationships with Patients
  - 
  - Obtaining consent
  - respecting confidentiality
  - maintaining trust
  - good communication
- Probity
  - Dealing with problems in professional practice
  - Handling complaints and formal inquiries

The framework for Residency training during these years will consist of clinical rotations with formal lectures which should give appropriate experience in relevant areas identified, broadly classified under
- System-based Training
- Technique-based training (CT, MRI, US, interventional and Radionuclide)

System-based Training :: Year 2-3-4

<table>
<thead>
<tr>
<th>Rotation</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiothoracic Imaging</td>
<td>4 Months</td>
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<tr>
<td>G.I.T. Imaging</td>
<td>4 Months</td>
</tr>
<tr>
<td>Musculoskeletal Imaging</td>
<td>3 Months</td>
</tr>
<tr>
<td>Neuroradiology Imaging</td>
<td>4 Months</td>
</tr>
<tr>
<td>Head &amp; Neck Imaging</td>
<td>2 Months</td>
</tr>
<tr>
<td>Paediatric Imaging</td>
<td>4 Months</td>
</tr>
<tr>
<td>Obstetrics &amp; gynecology Imaging</td>
<td>3 Months</td>
</tr>
<tr>
<td>Uroradiology Imaging</td>
<td>2 Months</td>
</tr>
<tr>
<td>Vascular Imaging</td>
<td>3 Months</td>
</tr>
<tr>
<td>Breast Imaging</td>
<td>2 Months</td>
</tr>
<tr>
<td>Nuclear Medicine Imaging</td>
<td>2 Months</td>
</tr>
</tbody>
</table>

Note: Emergency and Oncology Imaging will be covered during each relevant rotation.
## System-based Training

The following sections delineate the training objectives (knowledge, skills and experience) that will be acquired during Years 2, 3 & 4. Each component of the training program will have a clearly defined structure for the supervision of the resident by the assigned Radiologist. The assigned Radiologist will be assumed overall responsibility for the training given during that period, including the techniques performed and preliminary radiology reports issued by the resident.

<table>
<thead>
<tr>
<th>Core knowledge</th>
<th>Core skills</th>
<th>Core experience</th>
<th>Optional experience</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiac imaging</strong></td>
<td>• Cardiac anatomy &amp; clinical practice relevant to clinical radiology</td>
<td>• Reporting plain radiographs performed to show cardiac disease &amp; postoperative appearances</td>
<td>• Observation of:</td>
</tr>
<tr>
<td>• Manifestations of cardiac disease demonstrated by plain radiography</td>
<td>• Attending reporting session of common and relevant cardiac conditions shown by CT and MRI</td>
<td>• Contrast medium studies:</td>
<td>- Relevant radionuclide studies</td>
</tr>
<tr>
<td>• Application of techniques in Radionuclide, CT, MRI, angiography,</td>
<td></td>
<td>- CT, MRI performed to show cardiac disease</td>
<td>- Coronary and cardiac angiography</td>
</tr>
<tr>
<td>including coronary angiography</td>
<td></td>
<td>- Radionuclide lung scintigrams</td>
<td>- Interventional procedures</td>
</tr>
<tr>
<td><strong>Thoracic imaging</strong></td>
<td>• Thoracic anatomy and clinical practice relevant to clinical radiology</td>
<td>• Reporting of plain radiographs performed to show thoracic disease</td>
<td>• Catheter angiography</td>
</tr>
<tr>
<td>• Manifestations of thoracic disease as demonstrated by plain radiography and CT</td>
<td>• Supervising &amp; reporting:</td>
<td>• Observation of image-guided biopsies of lesions within the thorax</td>
<td></td>
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<tr>
<td>• Application of radionuclide investigations to thoracic pathology with</td>
<td>- Radionuclide lung scintigrams</td>
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<tr>
<td>particular reference to radionuclide lung scintigrams</td>
<td>- CT of the thorax, including high-resolution examinations &amp; CT pulmonary angiography</td>
<td></td>
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<tr>
<td>• Application risks &amp; contraindications of image-guided biopsy of thoracic</td>
<td>- Drainage of pleural space collections under image guidance</td>
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<tr>
<td>lesions</td>
<td></td>
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<tr>
<td><strong>Gastrointestinal &amp; abdominal imaging (including liver, pancreas and spleen)</strong></td>
<td>• GI and biliary anatomy and clinical practice relevant to clinical radiology</td>
<td>• Reporting plain radiographs performed to show GI disease</td>
<td>• Observation of ERCP and other diagnostic &amp; therapeutic endoscopic techniques</td>
</tr>
<tr>
<td>• Radiological manifestations of disease within the abdomen on plain</td>
<td>• Performing &amp; reporting following contrast examinations</td>
<td>• Performing &amp; reporting following contrast examinations</td>
<td>- T-tube cholangiography</td>
</tr>
<tr>
<td>radiography, contrast studies (including ERCP), US, CT, MRI,</td>
<td>- Swallow and meal examinations</td>
<td>• Percutaneous biliary procedures</td>
<td>- Percutaneous cholangiography</td>
</tr>
<tr>
<td>radionuclide investigations and angiography</td>
<td>- Small bowel studies</td>
<td>• Relevant application of following interventional procedures</td>
<td></td>
</tr>
<tr>
<td>• Applications, complications &amp; contraindications of relevant interventional</td>
<td>- Enema examinations</td>
<td>- Balloon dilatation of the esophagus /stent insertion</td>
<td>- Porto-systemic decompression</td>
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<tr>
<td>procedures</td>
<td>- Performing and reporting Tran abdominal US of the GI system and</td>
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<tr>
<td></td>
<td>- abdominal viscera</td>
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<tr>
<td></td>
<td>• Supervising &amp; reporting:</td>
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<td></td>
<td>- CT of the abdomen</td>
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<td></td>
<td>- MRI examinations of abdomen (eg. MRCP)</td>
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<td></td>
<td>• Performing:</td>
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<td></td>
<td>- US-guided biopsy &amp; drainage</td>
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<tr>
<td></td>
<td>- CT-guided biopsy &amp; drainage</td>
<td></td>
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<tr>
<td><strong>Musculoskeletal imaging</strong></td>
<td>• Musculoskeletal anatomy and clinical practice relevant to clinical</td>
<td>• Relevant contrast examinations (e.g., arthrography)</td>
<td>• Familiarity with the application of angiography</td>
</tr>
<tr>
<td>• Normal variants of normal anatomy, which may mimic trauma</td>
<td>to clinical radiology</td>
<td></td>
<td>• Observation of discography and facet joint injections</td>
</tr>
<tr>
<td>• Manifestations of musculoskeletal disease and trauma as demonstrated by</td>
<td>- Reporting Radionuclide investigations of musculo-skeletal system,</td>
<td></td>
<td>• Observing and performing image-guided bone and soft-tissue biopsy</td>
</tr>
<tr>
<td>plain radiography, CT, MRI, contrast examinations, radionuclide</td>
<td>particularly skeletal scintigrams</td>
<td></td>
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</tr>
<tr>
<td>investigations and US</td>
<td>- Supervising &amp; reporting CT/ MRI of the musculo-skeletal system</td>
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<tr>
<td></td>
<td>- Performing &amp; reporting US of musculoskeletal system</td>
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<tr>
<td></td>
<td>- Supervising CT and MRI of trauma patients</td>
<td></td>
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<tr>
<td>Core knowledge</td>
<td>Core skills</td>
<td>Core experience</td>
<td>Optional experience</td>
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<td>-------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
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<tr>
<td><strong>Neuroradiology</strong></td>
<td><strong>Core knowledge</strong></td>
<td></td>
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</tr>
<tr>
<td>- Neuro-anatomy and clinical practice relevant to neuroradiology</td>
<td>- Reporting plain radiographs in the investigation of neurological disorders</td>
<td>- Observation of cerebral angiograms and their reporting</td>
<td>- Performing and reporting</td>
</tr>
<tr>
<td>- Manifestations of central nervous system disease as demonstrated on plain</td>
<td>- Supervising and reporting:</td>
<td>- Observation of carotid Doppler ultrasound</td>
<td>- Cerebral angiograms</td>
</tr>
<tr>
<td>radiography, CT, MRI and angiography</td>
<td>- Cranial and spinal CT, including trauma</td>
<td>- Trans-cranial pediatric US</td>
<td>- Carotid Doppler ultrasound</td>
</tr>
<tr>
<td>- Applications, complications &amp; contraindications of invasive neuro-</td>
<td>- Cranial and spinal MRI</td>
<td>- Observation of Interventional neuro-radiological procedures</td>
<td>- Trans-cranial pediatric US</td>
</tr>
<tr>
<td>radiological procedures</td>
<td></td>
<td>- Observation of Advanced MRI techniques, including magnetic resonance spectroscopy</td>
<td></td>
</tr>
<tr>
<td>- Application of:</td>
<td></td>
<td>- CT perfusion techniques</td>
<td></td>
</tr>
<tr>
<td>- Radionuclide investigations in neuroradiology</td>
<td></td>
<td>- Functional brain imaging techniques (radionuclide/ MRI)</td>
<td></td>
</tr>
<tr>
<td>- CT &amp; magnetic resonance angiography in neuroradiology</td>
<td></td>
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<tr>
<td><strong>Head &amp; neck imaging including ENT &amp; Dental</strong></td>
<td><strong>Core skills</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Head &amp; neck anatomy and clinical practice relevant to clinical radiology</td>
<td>- Reporting plain radiographs performed to show Head and Neck disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Manifestations of Head and Neck disease as demonstrated by plain radiography, relevant contrast examinations, US, CT and MRI</td>
<td>- Performing &amp; reporting:</td>
<td></td>
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</tr>
<tr>
<td>- Application of:</td>
<td>- Relevant contrast examinations (eg. barium study)</td>
<td></td>
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<tr>
<td>- US with particular reference to the thyroid and salivary glands and</td>
<td>- US of neck (including the thyroid, parathyroid and salivary glands)</td>
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<tr>
<td>other neck structures</td>
<td>- CT of the head &amp; neck diseases</td>
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<tr>
<td>- Radionuclide investigations with particular reference to the thyroid /</td>
<td>- Supervising and reporting MRI of the head and neck Head and Neck disease</td>
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<tr>
<td>parathyroid glands</td>
<td>- Reporting radionuclide thyroid investigations</td>
<td></td>
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<tr>
<td><strong>Pediatric imaging</strong></td>
<td></td>
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<tr>
<td>- Pediatric anatomy and clinical practice relevant to clinical radiology</td>
<td>- Reporting plain radiographs performed in the investigation of pediatric</td>
<td>- Supervising and reporting CT, MRI and radionuclide investigations in the pediatrics</td>
<td>- Performing biopsies of neck masses (thyroid, lymphnodes etc)</td>
</tr>
<tr>
<td>- Disease entities specific to the pediatric age group &amp; their clinical</td>
<td>disorders including trauma</td>
<td>age group</td>
<td>- Reporting radionuclide para-thyroid investigations</td>
</tr>
<tr>
<td>manifestations relevant to clinical radiology as well as their manifestations</td>
<td>- Performing &amp; reporting US in pediatric age group</td>
<td></td>
<td>- Performing and reporting solography</td>
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<tr>
<td>demonstrated on plain radiography, US, contrast studies, CT, MRI and</td>
<td>- Supersive and report cranial CT studies, particularly in the setting</td>
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<tr>
<td>radionuclide investigations</td>
<td>of acute trauma</td>
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<tr>
<td>- Management of suspected non-accidental injury and the recognition of</td>
<td>- Performing and reporting routine fluoroscopic procedures in the pediatric</td>
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<tr>
<td>features of child abuse</td>
<td>age group, particularly:</td>
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<tr>
<td></td>
<td>- Contrast studies of the urinary tract</td>
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<tr>
<td></td>
<td>- Contrast studies of the GI system</td>
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<tr>
<td><strong>Obstetrics &amp; Gynaecology imaging</strong></td>
<td></td>
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</tr>
<tr>
<td>- Obstetric &amp; gynecological anatomy and clinical practice relevant to</td>
<td>- Reporting plain radiographs performed to show gynecological disorders</td>
<td>- Performing and reporting hysterosalpingography</td>
<td>- Practical management of the following pediatric emergencies</td>
</tr>
<tr>
<td>clinical radiology</td>
<td>- Performing and reporting:</td>
<td></td>
<td>- Neonatal GI obstruction</td>
</tr>
<tr>
<td>- Physiological changes affecting imaging of the female reproductive organs</td>
<td>- Trans-abdominal &amp; endovaginal US in gynecological disorders, including</td>
<td></td>
<td>- Intussusception</td>
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<tr>
<td></td>
<td>possible complications of early pregnancy (e.g. ectopic)</td>
<td></td>
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<tr>
<td>- Changes in maternal/ fetal anatomy during gestation</td>
<td>- Routine obstetric US including identification of common fetal abnormalities.</td>
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<tr>
<td></td>
<td>- Supervising &amp; reporting CT/ MRI in gynecological disorders</td>
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<td>- Applications of angiography and vascular interventional techniques</td>
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<tr>
<td>- Awareness of the applications of MRI in gynecological disorders and</td>
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<tr>
<td>obstetrics</td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>Core knowledge</th>
<th>Core skills</th>
<th>Core experience</th>
<th>Optional experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core knowledge</td>
<td>Core skills</td>
<td>Core experience</td>
<td>Optional experience</td>
</tr>
</tbody>
</table>
| Uroradiology imaging | • Urinary tract anatomy and clinical practice relevant to clinical radiology  
  • Manifestations of urological disease as demonstrated on plain radiography, US, CT & MRI  
  • Applications of radionuclide investigations for imaging the following:  
    - Renal structure  
    - Renal function  
    - Vesico-ureteric reflux  
  • Application of angiography and vascular interventional techniques | • Reporting plain radiographs performed to show urinary tract disease  
  • Performing & reporting following contrast studies:  
    - Intravenous urogram  
    - Retrograde pyelo-ureterography  
    - Nephrostogram  
    - Ascending urethrography  
    - Micturating cysto-urethrography  
  • Performing and reporting trans-abdominal US to image the urinary tract  
  • Supervising & reporting CT of the urinary tract  
  • Reporting radionuclide investigations of the urinary tract, specifically of Renal structure & function and Vesico-ureteric reflux | • Drainage of renal abscesses and peri-renal collections  
  • Observation of Nephrostomies  
  • Observation of percutaneous ureteric stent placement  
  • Observation of Endorectal US  
  • Performing image-guided renal biopsy under US and/or CT guidance  
  • MRI applied to the urinary tract  
  • Angiography and vascular interventional techniques  
  • Antegrade pyelo-ureterography | • Urodynamics  
  • Performing nephrostomies  
  • Percutaneous nephrolithotomy  
  • Lithotripsy |
| Breast imaging | • Breast anatomy, pathology and clinical practice relevant to clinical radiology  
  • Radiographic techniques employed in diagnostic mammography  
  • Principles of current practice in breast imaging and breast cancer screening  
  • Proper application of other imaging techniques to this specialty (e.g. US, MRI & Radionuclide) | • Mammographic reporting of common breast disease | • Participation in:  
  - Mammographic reporting sessions.  
  - Breast multidisciplinary meetings  
  • Performing ultrasound of the breast  
  • Observation of breast biopsy & localization | • Performing Breast biopsy and localization |
| Oncology | • Oncological pathology and clinical practice relevant to clinical radiology  
  • Tumor staging nomenclature  
  • Application of US, radionuclide investigations, CT and MRI, angiography & interventional techniques in oncological staging, and monitoring the response of tumors to therapy  
  • Radiological manifestations of complications which may occur in tumor management | • Reporting plain radiographs performed to assess tumors  
  • Performing and reporting US, CT, MRI and radionuclide investigations (including PET/CT) in oncological staging and monitoring the response of tumors to therapy  
  • Performing image-guided biopsy of masses under US and CT guidance | • Participation in multidisciplinary meetings | |
| Vascular imaging | • Vascular anatomy and clinical practice relevant to clinical radiology  
  • Indications, contraindications, pre-procedure preparation (including informed consent), sedation and anesthetic regimens, patient monitoring during procedures, procedural techniques and post-procedure patient care  
  • Applications of the following techniques:  
    - US (including Doppler)  
    - Digital subtraction techniques  
    - CT and CT angiography  
    - MRI and MRI angiography  
    - intra-arterial angiography  
    - Attending vascular interventional sessions. | • Imaging  
  • Reporting plain radiographs relevant to cardio-vascular disease  
  • Performing and reporting:  
    - Lower limb venography (contrast medium/ US)  
    - US (including Doppler), venous and arterial  
  • Supervising and reporting CT examinations of the vascular system including image reformation. | | |
**Technique-based training (CT, MRI, US, interventional and Radionuclide):**

The core training objectives for the following technique-based training - CT, MRI, interventional radiology, and Ultrasound all have been incorporated into the system-based modules and listed below for reference.

**Computed tomography**
- Technical aspects of performing CT, including the use of contrast media.
- Cross-sectional anatomy as demonstrated by CT
- Practical experience in supervision including vetting requests, determining protocols, the examination, and post-processing and reporting of the examination in the following anatomical sites:
  - Brain
  - Head & neck
  - Chest
  - Abdomen & pelvis
  - Musculoskeletal
  - Vascular
- Experience in performing CT-guided procedures, e.g., biopsy and drainage
- Application of CT venography and angiography
- Post-image acquisition processing

**Magnetic resonance imaging**
- Understanding of current advice regarding the safety aspects of MRI
- Basic physical principles of MRI, including the use of contrast media
- Cross-sectional anatomy in orthogonal planes, and the appearance of normal structures on different pulse sequences
- Experience in supervision including vetting requests, determining protocols, the examination, and post-processing and reporting of the examination in the anatomical sites (brain, head & neck, chest, abdomen & pelvis, musculoskeletal (e.g., Hips, knees, shoulders & extremities)
- Application of magnetic resonance angiography and venography
- Post-image acquisition processing

**Radionuclide radiology**
- Relevant aspects of current legislation regarding the administration of radiopharmaceuticals
- Technical aspects of radionuclide radiology relevant to optimizing image quality
- Radiopharmaceuticals currently available for the purposes of imaging organs and locating inflammatory collections, tumors and sites of hemorrhage
- Relevant patient preparation, precautions (including drug effects), and complications of the more commonly performed radionuclide investigations
- Understanding of the principles and indications of the more commonly performed radionuclide investigations and how these relate to other imaging techniques, in particular knowledge of the radionuclide investigations in the following topic areas:
  - Cardiology
  - Endocrinology
  - Hematology
  - Infection
  - Lung disease
  - Nephro-urology
  - Nervous system
  - Oncology
  - Pediatrics
  - Skeletal disorders
  - Gastroenterology and hepatobiliary disease
- Understanding the significance of normal and abnormal results
- Strengths and weaknesses of radionuclide investigations compared to other imaging modalities
- Supervision and reporting of radionuclide investigations
- Appreciation of functional/anatomical imaging including hybrid technologies such as PET-CT and SPECT-CT
  - Knowledge of the role of PET-CT in the staging of the common malignancies (lung, colon, etc)
  - Understanding of the role of PET-CT in other tumor groups and its potential use in cardiology and neurology
Ultrasound

- Technical aspects of US relevant to optimizing image quality
- Cross-sectional anatomy as visualized on US
- Performing and reporting trans-abdominal US examination of structures in the following anatomical areas:
  - General abdomen (including vessels)
  - Pelvis (non-obstetric)
  - Small parts (scrotum, thyroid, neck structures)
  - Upper abdomen (including lower chest)
- Performing Doppler US imaging (e.g. leg veins, portal vein, carotid artery)
- Performing US of the breast
- Performing US-guided interventional procedures (e.g. biopsy and drainage)
- Knowledge of infection control and probe cleaning

Optional

- Obstetric USS
- Performing Tran cranial pediatric USS
- Performing musculoskeletal USS.

Interventional radiology

- Familiarity with the equipment and techniques used in vascular, biliary, and renal interventional techniques
- Indications, contraindications, pre-procedure preparation including informed consent, patient monitoring during the procedure and post-procedure patient care
- Familiarity with procedure and post-procedure complications and their management
- US-guided interventional procedures (e.g. biopsy and drainage)
- CT-guided interventional procedures (e.g. biopsy and drainage)

Optional

- Performing nephroscopy
- Observation of angioplasty and stenting techniques
- Observation of the spectrum of interventional procedures currently performed in the following systems:
  - Vascular system (including neurovascular)
  - Urinary system
  - Biliary system
  - GI and abdominal system
  - Musculoskeletal system
- MRI-guided interventional procedures

On-Call Duty

Each resident will participate in an appropriate on-call Rota in order to be exposed to acute and emergency radiology, in which he/she will be responsible to the assigned Radiologist. This should commence during the third year of training, although on-call experience at an earlier stage also provides valuable training opportunities.

In the operating theatres, the Consultant or supervising physicians are responsible for the supervision of all operative cases. Consultants or supervising physicians must be present in the operating room with residents during critical parts of the procedure. For less critical parts of the procedure, the Consultant or supervising physician must be immediately available for direct participation.
Syllabus

Physic Syllabus :: Detailed Anatomy and Techniques Syllabus

MODULE 1: Thorax and Cardiovascular

Anatomy
- Anatomy of the heart, coronary arteries, aorta, great vessels, vascular structures of the thorax and mediastinum, as demonstrated by radiography, contrast studies and cross sectional imaging
- Anatomy of the lungs, including segmental anatomy, bronchial tree and pleura, as demonstrated by radiography, bronchography and cross-sectional imaging
- Anatomy of arterial, venous and lymphatic systems of the whole body

Techniques
Knowledge is required of the techniques listed below
- Plain film techniques for imaging the thorax, with knowledge of how variation in exposure factors influences the final image
- Basic knowledge of bronchography, coronary angiography, magnetic resonance angiography and radionuclide techniques
- CT and MRI in the thorax, including high resolution CT (HRCT) and CT pulmonary angiography (CTPA)
- Angiographic techniques for imaging the aorta, great vessels and peripheral vascular system, with a knowledge of common interventional procedures
- Contrast venography of arms, legs and central veins
- Ultrasound imaging of the heart, arterial and venous systems, including uses and applications of Doppler, colour Doppler and power Doppler imaging
- Imaging of the lymphatic system, especially with radionuclide techniques

MODULE 2: Musculoskeletal

Anatomy
- Anatomy of the skull and facial bones
- Anatomy of the skeleton, including knowledge of the major ossification centers with times of fusion and the common anomalies and variants that may mimic disease
- Anatomy of the muscles and other soft tissues, as demonstrated by ultrasound, CT and MRI

Techniques
Knowledge is required of the techniques listed below
- Plain film techniques for imaging the skeletal system, including specific projectional techniques
- Ultrasound, CT and MRI techniques for the examination of the skeletal system and soft tissues
- Arthrographic techniques, including CT
- The use of radionuclide imaging in the skeletal system
- Interventional techniques

MODULE 3: Gastro-intestinal

Anatomy
- Anatomy of the oropharynx, oesophagus, stomach, duodenum, small bowel and colon, as demonstrated by radiography, contrast studies and cross-sectional imaging
- Cross-sectional anatomy of the liver, gall bladder and biliary tree, pancreas & spleen, as demonstrated by US, CT and MRI
- Anatomy of the peritoneum and retroperitoneum, as demonstrated by cross-sectional imaging
- Anatomy of the biliary tree, as demonstrated by direct choangiography and ERCP, ultrasound and MRCP
- Anatomy of the vascular supply of the upper abdominal viscera, as demonstrated by ultrasound, CT, MRA and angiography

Techniques
- Plain film radiography of the abdomen
- Contrast studies of the intestinal tract, including video studies of the upper gastro-intestinal tract and sialography
- Techniques for imaging the biliary tract, including ERCP and MRCP
- Common techniques for cross-sectional imaging of the gastro-intestinal tract and upper abdominal organs
- Optimization of cross-sectional imaging for specific applications by manipulation of physical variables, e.g. ultrasound frequency, CT pitch
- Use of contrast agents in cross-sectional imaging of the abdomen
- Common diagnostic and therapeutic interventional procedures.
- Common radionuclide imaging techniques
MODULE 4: Genito-urinary, Adrenal, Obstetrics & Gynaecology and Breast

Anatomy
- Anatomy of the urinary tract, adrenal glands, male and female genital tracts, including the pregnant uterus
- Anatomy and dating of the developing normal fetus
- Anatomy of the female breast

Techniques
Knowledge is required of the techniques listed below
- Plain film radiography of abdomen and pelvis
- Common contrast techniques for the examination of the renal tract, including intravenous urography, antegrade and retrograde pyelography, cystography, urethrogram and nephrostogram
- CT and MRI examinations of the kidneys, adrenals and male and female pelvis
- Radionuclide techniques for evaluating renal function
- Ultrasound techniques for examining the renal tract and male and female genital tracts, including endocavity examination of prostate and female pelvis and Doppler techniques
- Ultrasound of early pregnancy complications, e.g. ectopic pregnancy
  Ultrasound and contrast hysterosalpingography
- Mammography, ultrasound and MRI of the breast
- Nephrostomy insertion, ureteric stenting, renal biopsy procedures, angiographic and vascular interventional techniques
- Breast biopsy techniques

MODULE 5: Pediatrics

Anatomy
- The normal anatomy and changing appearances of the growing child, including epiphyseal ossification and common variants that may mimic disease. (Detailed knowledge of appearance of ossification centers is not required.)

Techniques: Knowledge is required of the techniques listed below
- Plain radiographic techniques of chest, abdomen and skeleton
- Contrast studies of the gastro-intestinal and urinary tracts
- Common paediatric ultrasound techniques, including cranial, musculoskeletal, abdominal and pelvic studies
- CT and MRI examinations of the child
- Radionuclide imaging techniques
- Interventional techniques

MODULE 6: Central Nervous & Head and Neck

Anatomy
- Skull, facial bones and spine
- Brain, spinal cord and meninges, including cerebral and spinal vascular anatomy
- Thyroid, parathyroid and salivary glands
- Paranasal sinuses, teeth, pharynx and larynx
- Orbit, including the lacrimal apparatus

Techniques: Knowledge is required of the techniques listed below
- Plain radiography of the skull, facial bones and teeth
- Cross-sectional imaging with CT, MRI and ultrasound
- Imaging of the intracranial circulation, including intra-arterial angiography and CT and MR angiography
- Radionuclide imaging
- Contrast examinations, e.g. barium studies
- Interventional techniques
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**For the Medical Physics Section:** Ms. Sara Buhumaid, Head of Medical Physics Section (MPS) * Mr. Abderrachid Zitouni, Consultant Medical Physicist / MPS
Residents are required to present a research through final year thesis and for this purpose, workshops are held as follows:
- Research methodology (3 days)
- Literature review & Resources (1 day)
- SPSS (Basic Statistics)

The goal of these workshops is to understand and able to apply the following:
- Using electronic databases such as Medline & Internet to conduct literature searches and to locate information
- Critically appraise/evaluate relevant literature, reviews and new techniques/technologies
- Use word processors, databases, spreadsheets and statistical packages to produce statistical analysis & research papers
- Conduct a literature review
- Develop an hypothesis to be tested
- Choose an appropriate research methodology and design a research study
- Write a grant application to fund a research project.
- Apply for ethics committee approval for a clinical or laboratory based study
- Collect, collate and interpret data
- Apply basic statistical analysis to clinical data
- Develop an outline structure for a research paper
- Write a literature review for a research paper
- Apply the developed outline to write a research paper
- Searching the literature and data-bases purposefully
- Appraising critically relevant articles and reports
- Interpreting findings and consider their applications to other contexts
- Know how to select and draw on clinical evidence to inform practice
- Be able to define the following terms
  - Clinical significance
  - Statistically significant / insignificant
  - Variability
  - Biological variability
  - Laboratory variability
  - Observer variability
  - Data types: categorical, continuous, qualitative, quantitative, discrete
- Understand the following methods of and terms associated with data collection:
  - Epidemiological studies
  - Randomized controlled & crossover clinical trials
  - Randomized controlled laboratory study
  - Observational studies
  - Discrete and continuous variables
  - Sample size determination
- Recognize and understand the following concepts of problems associated with data:
  - Bias: confounding - measurement - sampling
  - Randomization
  - Stratification
  - Blindness (masking)
  - Relevance of sample size to the ultimate
  - Outcome of the statistical analysis
  - Understand the significance & limitations of measures of central tendency:
    - Mean, median, mode
    - Variance
    - Co-variance
    - Standard deviation
    - Confidence interval
  - Meta-analysis
  - Absolute risk
    - Absolute risk difference
    - Absolute risk reduction
  - Attributable risk
  - Etiologic fraction
  - Relative Risk
- Understand and apply the following statistical terms:
  - Probability & probability distribution models
  - Regression and correlation analysis
  - Risk – sensitivity analysis, particularly:
  - Exposure odds ratio
  - Number needed to treat
  - Significance testing
  - Meta-analysis
  - Absolute risk
    - Absolute risk difference
    - Absolute risk reduction
- Getting Research skills:
  - Choosing a topic for research
  - Having a detailed literature review for this purpose
  - Designing a research as per standard methodology
  - Choosing a mentor on the related field
  - Finalize the research proposal and get both scientific and ethical approval
  - The research proposal will consist of at least of Title page, Specific Aims
  - Introduction/Background and Significance
  - Objectives and Hypothesis
  - Research Design and Methodology
  - References / Bibliography
  - Conduct the research through data gathering, survey, or any standard tool
  - Analyze the data
  - Present the data on a thesis as per DRTP thesis guidelines.
Each thesis must be arranged in the following order:
- Title Page (Sample A). Do not place a page number on this page.
- Dedication. Do not place a page number on this page.
- Acknowledgements and/or Prelude. Do not place a page number on this page.
- Abstract (Sample B). Do not place a page number on this page.
- Table of Contents. Do not place a page number on this page.
- List of Tables, Figures, Illustrations/Maps/Slides, List of Supplemental Files such as multimedia files.
- List of abbreviations
- Text of the Thesis. All pages from the first page of text through the bibliography or Vita, if included, are numbered consecutively in Arabic numerals, beginning with Arabic numeral “1” on the first page of the thesis text.
- Introduction
- Material and Methods
- Results
- Discussion
- Limitations
- Conclusion
- Appendix or Appendices. Continue text numbering with Arabic numerals.
- References. Vancouver or Harvard standard style.
- Publications (please insert the full text of your published paper if you have any)
- Curriculum Vita. Continue text numbering with Arabic numerals.

**Thesis Formatting and Layout Requirements:**

| Margin | Page size should be standard A4 size (8.50 x 11.00),
| Page Nos. | 1 inch on all sides, including page numbers.
| Spacing | Preliminary pages and text must be double-spaced or 1.5-spaced. Under certain conditions, quotations may be single spaced. Table of Contents and lists with lengthy entries may be single spaced with a double space between entries. References may be single spaced, with a double space between entries.
| Page Alignment | Each new chapter/major section (i.e. Chapter 1 - 2, Appendix, Bibliography, Vita) must begin on a new page.
| Pagination | All text page in the thesis is numbered.
| Word Processing | All text pages in the thesis must be centered under the text in the same location on each page and located at least one inch from the bottom of the page.
| Tables & Illustrations | Your final thesis must be correct in spelling and punctuation and presented in a consistent, structured format.
| Captions & legends | A single, legible font must be used throughout the thesis, the only exceptions being in tables, figures, graphs, appendices, footnotes, and supplemental files. The font size should be 12pt. Accuracy and consistency is required in format of the thesis.
| Tables & Illustrations | Pages carrying illustrative material must be given page numbers appropriate to their place in the document.
| Illustrations | Illustrative material may not be inserted after the document has been numbered and given numbers such as “10a.” All tables, figures, illustrations, and other types of examples included and referenced in the text of the thesis must be centered for identification.
| Illustrations | There should be no duplication of these numbers; i.e., no two tables should be assigned the same number. Figures may be numbered in one of two ways: consecutively throughout the document (Table 1, Table 2, Table 3, etc.), or double-numbered so that illustrations’ numbers reflect their locations in the document (Fig. 9.3 is the third figure in Chapter 9, or Fig. A2 is the second figure in Appendix A.)
| Captions & legends | To be placed on the same page with the figure, graph, table or illustration they describe. In order to fit both figure and caption on the same page, captions may be single-spaced, margins may be decreased to one inch, and figures may be reduced in size to fit. If the figures are reduced from their original size, then the page number must be added after the reduction so as not to alter its size. If there is no other way to manage the amount of material to be shown, the caption and figures should be side-by-side in continuous view. This method should only be used in the rare instance where all of the pertinent material will not fit on the same page. Figures, captions, and page numbers must be easily readable when the electronic document is viewed at 100 percent.
| Copies Required | Residents upload a single pdf file of their thesis to Research website (e.g. thesis submission site). The electronic pdf file serves as the DHA archival copy of the thesis. As an extra measure of security, students are strongly encouraged to keep a copy of their approved thesis and to provide an additional copy to their thesis supervisor or department/program library, if applicable. By keeping an electronic backup on-hand, students can easily provide scholars with a copy of the thesis during the time between submission and publication, if necessary. A paper copy of the thesis is required by the AAC.
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Glossary

FANR: Federal Authority of Nuclear Regulations

FANR is the regulatory body in the UAE in charge of:
- Developing regulations and Safety Standards
- Licensing of Radiation Users;
- Inspecting Radiation Facilities; Enforcing the UAE Regulations