

# DIAGNOSTIC RADIOLOGY RESIDENCY

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## TRAINING REQUIREMENTS

### (A) INTRODUCTION

- A. Definition and Scope of the Specialty  
The specialty of diagnostic radiology encompasses a variety of diagnostic and image guided therapeutic techniques, including all aspects of image-based diagnosis, such as radiography, nuclear radiology, diagnostic ultrasound, magnetic resonance, computed tomography, interventional procedures, and molecular imaging.
- B. Duration of Training  
The duration of diagnostic radiology training is 60 months in length. (R1 to R5.)

### (B) PROGRAMME OVERVIEW

- 48 months (R1 – R4, ACGME-I accredited)
- 12 months (R5, non ACGME-I accredited)

### (C) TRAINING REQUIREMENTS R1 – R4

#### COMPULSORY REQUIREMENTS

All R1 residents will take and pass a National Plain Film Test after 6 months of training before being allowed to read and report plain X-rays with access to specialist consults as well as being subjected to audits for quality. The discrepancy rates of residents will be tracked and reported to the Residency Advisory Committee (RAC) on a quarterly basis. Senior residents, R4 & R5 may supervise R1-3 residents as part of their progressive responsibilities.

The resident must pass the Fellowship of the Royal College of Radiologists (FRCR) 2A (Clinical Radiology) examination before progression to R4.

#### CLINICAL EXPERIENCE

1. The resident will be educated in the nine subspecialty areas of diagnostic radiology, which are neuroradiology, musculoskeletal radiology, vascular and interventional radiology, cardiothoracic radiology, breast radiology, abdominal radiology, pediatric radiology, ultrasonography (including obstetrical and vascular ultrasound), and nuclear radiology (including PET and nuclear cardiology). The maximum period of education in any one of the nine subspecialty areas during the R1 to R4 years shall be 16 months.
2. Residents must have 2- 4 months of education and experience in nuclear radiology.
3. Each resident must participate with preceptors in at least 3 therapies involving oral administration of I-131 with documentation of the date, diagnosis, and dose.
4. Residents must have clinical rotations in breast imaging after completing the 1st year of their specialty education. Residents should document the interpretation/multi-reading of at least 240 mammograms.

5. Residents must have documented supervised experience in interventional procedures, which includes image-guided biopsies, drainage procedures, angioplasty, embolization and infusion procedures, and other percutaneous -interventional procedures to include the performance, interpretation, and complications of vascular, interventional, and invasive procedures.
6. Participation in on-call activities is essential for the development of radiologists who are expected to practice independently upon completion of training and should occur throughout the second, third, and four year of diagnostic radiology residency.
7. The resident must have a minimum of 12 months in the educational program before taking independent in-house on-call responsibilities.
8. Residents should attend interdepartmental conferences in which both residents and faculty participate on a regular basis.
9. Senior residents should have experience in supervising or acting as consultants to and teaching medical students and residents.

### **DIDACTIC SESSIONS**

1. The curriculum will include subspecialty specific and general content.
2. The program will have a minimum of five hours per week of conferences/lectures throughout the year; these lectures may be supplemented with other educational materials as well as interactive conferences.
3. At least 80 hours of didactic (classroom and laboratory training) education under the direction of an authorized preceptor must occur, that includes:
  - a. diagnostic radiologic physics, instrumentation, and radiation biology;
  - b. patient and medical personnel safety (i.e., radiation protection);
  - c. the chemistry of by-product material for medical use;
  - d. biologic and pharmacologic actions of materials administered in diagnostic and therapeutic procedures; and,
  - e. topics in safe handling, administration, and quality control of radionuclide doses used in clinical medicine.
4. A didactic component for each of the nine subspecialty areas is required. The content should include all age groups (adults and children) as well as cover relevant anatomy, physiology, disease processes, and imaging. This includes training in the acquisition and interpretation of conventional radiography, computed tomography, magnetic resonance imaging, angiography, and nuclear radiology examinations of the cardiovascular system (heart, coronary arteries and great vessels).
 

The didactic components must address general content which includes:

  - a. appropriate imaging utilization (Proper sequencing; cost-benefit analysis);
  - b. radiologic/pathologic correlation (This requirement may be satisfied by resident participation in a formal course on radiologic-pathologic correlation.);
  - c. fundamentals of molecular imaging;
  - d. biologic and pharmacologic actions of materials administered in diagnostic or therapeutic procedures;
  - e. use of needles, catheters, and other devices employed in invasive image-based diagnostic and therapeutic procedures; and,
  - f. socioeconomics of radiologic practice
5. Didactic instruction (and accompanying work experience ) when appropriate must include:
  - a. ordering, receiving, and unpacking radioactive material safely, and performing the related radiation surveys;
  - b. safe elution and quality control (QC) of radionuclide generator systems; calculating, measuring, and safely preparing patient dosages; calibration and QC of survey meters and dose calibrators;

- c. safe handling and administration of therapeutic doses of unsealed radionuclide sources (i.e., I-131);
  - d. written directives;
  - e. response to radiation spills and accidents (containment and decontamination procedures);
  - f. radiation signage and related materials;
  - g. using administrative controls to prevent medical events involving the use of unsealed by product material.  
(Residents must demonstrate hands-on work experience when they perform the above supervised work experience.)
6. Residents must maintain current basic cardiac life-support (BCLS) certification.
  7. Advanced cardiac life-support (ACLS) certification training is recommended.
  8. Other didactic components include multidisciplinary rounds, morbidity and mortality conferences, journal or evidence based reviews, case-based planned didactic experiences, seminars and workshops to meet specific competencies, computer-aided instructions and radiology grand rounds.

### **RESIDENTS' SCHOLARLY ACTIVITIES**

Residents must engage in a scholarly project under faculty supervision. This may take the form of laboratory research, clinical research, the analysis of disease processes, imaging techniques, or practice management issues.

1. The results of such projects must be published or presented at institutional, local, regional, or national meetings.
2. The program will specify how each project will be evaluated.

### **KEY COMPETENCIES**

The training programme aims to achieve the desired outcomes in the 6 key competencies of Patient Care, Medical Knowledge, Practice-based learning and Improvement, Interpersonal and Communication Skills, Professionalism and System-based practice.

#### **A. Patient Care**

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents must demonstrate competence in:

1. safe, efficient, appropriately utilized, quality-controlled diagnostic and/or interventional radiology techniques;
2. communicating effectively and in a timely manner the results of procedures, studies, and examinations to the referring physician and/or other appropriate individuals;
3. functioning as consultants for other health care professionals, and act as a resource for information regarding the most appropriate use of imaging resources;
4. accessing, interpreting, and applying best scientific evidence to the care of patients (evidence based medicine); and,
5. their awareness of radiation exposure, protection, and safety, as well as the application of these principles in imaging.

#### **B. Medical Knowledge**

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social behavioral sciences, as well as the application of this knowledge to patient care. Residents must demonstrate knowledge of:

1. diagnostic radiologic physics, instrumentation, and radiation biology;
2. patient and medical personnel safety (i.e., radiation protection, MRI safety);
3. the chemistry of by-product material for medical use;

4. biologic and pharmacologic actions of materials administered in diagnostic and therapeutic procedures;
5. the safe handling, administration, and quality control of radionuclide doses used;
6. appropriate imaging utilization (proper sequencing; cost-benefit analysis);
7. radiologic/pathologic correlation;
8. fundamentals of molecular imaging;
9. use of needles, catheters, and other devices employed in invasive image-based diagnostic and therapeutic procedures; and,
10. socioeconomics of radiologic practice.

C. Practice-based Learning and Improvement

Residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Residents are expected to develop skills and habits to be able to meet the following goals:

1. identify strengths, deficiencies, and limits in one's knowledge and expertise;
2. set learning and improvement goals;
3. identify and perform appropriate learning activities;
4. systematically analyze practice using quality improvement methods, and implement changes with the goal of practice improvement;
5. incorporate formative evaluation feedback into daily practice;
6. locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;
7. use information technology to optimize learning; and,
8. participate in the education of patients, families, students, residents and other health professionals.

D. Interpersonal and Communication Skills

Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Residents are expected to:

1. communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;
2. communicate effectively with physicians, other health professionals, and health related agencies;
3. work effectively as a member or leader of a health care team or other professional group;
4. act in a consultative role to other physicians and health professionals; and,
5. maintain comprehensive, timely, and legible medical records, if applicable.

E. Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:

1. compassion, integrity, and respect for others;
2. responsiveness to patient needs that supersedes self interest;
3. respect for patient privacy and autonomy;
4. accountability to patients, society and the profession;
5. sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation; and,
6. ethical and medical jurisprudence.

F. Systems-based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:

1. work effectively in various health care delivery settings and systems relevant to their clinical specialty;

2. coordinate patient care within the health care system relevant to their clinical specialty;
3. incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population-based care as appropriate;
4. advocate for quality patient care and optimal patient care systems;
5. work in inter-professional teams to enhance patient safety and improve patient care quality; and,
6. participate in identifying system errors and implementing potential systems solutions.

## **(D) TRAINING REQUIREMENTS R5**

### 1. Foundational Requirements

The R5 year must be in compliance with ACGME-I's Foundational Requirements.

### 2. Specialty Specific Requirements

#### **ENTRY REQUIREMENTS**

- Obtained the FRCR (Clinical Radiology) or Masters in Medicine (Diagnostic Radiology) Final examination before progression to R5.
- Completed 4 years of accredited Diagnostic Radiology ACGME-I residency program or equivalent.
- Programme Director (PD) certification of successful completion of R4.

#### **COMPULSORY REQUIREMENTS IN R5**

The 12-month R5 programme will be under the purview of the Diagnostic Radiology Residency Advisory Committee (DR RAC) and provided by the accredited Sponsoring Institutions (SI) in Singapore. The training duration for R5 Senior Residency in Diagnostic Radiology will be 12 months in duration and include the following:

- To complete 4 rotations on 3-monthly recognised subspecialty blocks
- This can be in combinations of 1 to 4 subspecialties in accredited SIs, subject to approval by DR RAC
- Compulsory single 3-month rotation to be posted out to another SI in Singapore, to be co-ordinated by DR RAC
- For each specific subspecialty block, at least 50% of the clinical time should be spent on that specific subspecialty

List of recognised subspecialties:

1. Neuroradiology
2. Musculoskeletal Radiology
3. Vascular and Interventional Radiology
4. Cardiothoracic Radiology
5. Breast Radiology
6. Abdominal Radiology
7. Paediatric Radiology
8. Ultrasonography (including Obstetrical and Vascular Ultrasound)
9. Nuclear Radiology (including PET and Nuclear Cardiology)

### 3. Senior Resident Competencies

	R5
1. <i>Patient Care</i>	<i>Practice evidence based medicine, clinical and patient orientated radiology with a culture of safety all the time.</i>
2. <i>Medical Knowledge</i>	<i>Demonstrate more in depth subspecialty level knowledge in one or more areas of interest, while maintaining competency for general radiology</i>
3. <i>Practice-based Learning and Improvement</i>	<i>Demonstrates self-evaluation and self-directed learning, have participated in at least one quality improvement project.</i>
4. <i>Interpersonal and Communication Skills</i>	<i>Have necessary communication skills as a leader of a care team or in more complex scenarios.</i>
5. <i>Professionalism</i>	<i>Fully understands and always practice in a professional manner.</i>
6. <i>Systems-based Practice</i>	<i>Understand system based practice on in the context of a national healthcare system.</i>

## (E) LOG OF OPERATIVE / CLINICAL EXPERIENCE

All residents must keep a log of their operative / clinical experience in the designated case log system. (Please refer to Annex A). In addition, the R5 senior resident must also have a record of Continued Medical Education (CME) activities as a reflection of self-directed lifelong learning.

## (F) ASSESSMENT AND EXAMINATIONS

### I. Supervisors Assessment

The supervisor's evaluation of the resident should be performed at the end of every rotation using the designated form and then submitted to the RAC for review.

### II. Feedback

Residents should perform a yearly evaluation of teaching faculty and the training programme using the designated forms. These forms must be submitted to the RAC and kept absolutely confidential.

### III. Examinations

Residents should pass the following specific examination before next residency progression and upon exit.

R1	R2	R3	R4	R5
NA	NA	FRCR 2A	Final FRCR 2B or Masters in Medicine (Diagnostic Radiology)	ABMS-I MCQ

## **(G) CHANGES IN TRAINEESHIP PERIOD AND LEAVE OF ABSENCE**

### **I. Changes in Training Period**

Residency should be continuous. If a training programme is interrupted for any reason whatsoever, the RAC may at its discretion, require the resident to undergo a further period of training in addition to the minimum requirements of the programme or terminate the residency altogether. All residents are required to conform to the residency training plan as approved by the RAC and complete all the exit and training requirements within the maximum candidature.

### **II. Leave Of Absence**

All residents are to comply with the prevailing MOH policy on Leave of Absence.

### **III. Overseas Postings**

Overseas attachment during Senior Residency training is not permitted with the exception of Radiation Oncology and Neurosurgery (*refer to JCST Circular 114/14*).