Specialty Training Requirements (STR)

Name of Specialty:	Diagnostic Radiology
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Contents

Scope of Diagnostic Radiology

Diagnostic Radiology encompasses a variety of diagnostic and image guided therapeutic techniques, including all aspects of image-based diagnosis, such as radiography, fluoroscopy, diagnostic ultrasound, magnetic resonance, computed tomography, nuclear radiology, interventional procedures, functional and molecular imaging.

Purpose of the Residency Programme

The residency programme in Diagnostic Radiology prepares the residents to conduct and interpret image-based diagnosis and image-guided therapeutic techniques safely and effectively. The areas covered include medical physics, radiological anatomy, techniques, radiography, fluoroscopy, ultrasonography, computed tomography, magnetic resonance imaging, nuclear radiology, functional and molecular imaging as well as vascular and interventional radiology.

The programme provides educational opportunities for residents to develop competence in the following areas: Patient Care and Procedural Skills, Medical Knowledge, System-based Practice, Practice-based Learning and Improvement, Professionalism, Interpersonal and Communication Skills, and Teaching and Supervisory Skills.

Admission Requirements

At the point of application for this residency programme,

a) applicants must be employed by employers endorsed by Ministry of Health (MOH); and

b) residents who wish to switch to this residency programme must have waited at least one year between resignation from his/her previous residency programme and application for this residency programme.

At the point of entry to this residency programme, residents must have fulfilled the following requirements:

c) Hold a local medical degree or a primary medical qualification registrable under the Medical Registration Act (Second Schedule);

d) Have completed Post-Graduate Year 1 (PGY1); and

e) Have a valid Conditional or Full Registration with Singapore Medical Council.

Selection Procedures

Applicants must apply for the programme through the annual residency intake matching exercise conducted by MOH Holdings (MOHH).

Continuity plan: Selection should be conducted via a virtual platform in the event of a protracted outbreak whereby face-to-face on-site meeting is disallowed and cross institution movement is restricted.

Less Than Full Time Training

Less than full time training is not allowed. Exceptions may be granted by Specialist Accreditation Board (SAB) on a case-by-case basis.

Non-traditional Training Route

The programme should only consider the application for mid-stream entry to residency training by an International Medical Graduates (IMG) if he/she meets the following criteria:

a) He/she is an existing resident or specialist trainee in the United States, Australia, New Zealand, Canada, United Kingdom and Hong Kong, or in other centres/countries where training may be recognised by the Specialist Accreditation Board (SAB); and

b) His/her years of training are assessed to be equivalent to the local training by JCST and/or SAB.

Applicants may enter residency training at the appropriate year of training as determined by the Programme Director and RAC. The latest point of entry into residency for these applicants is Year 1 of the senior residency phase.

Separation

The PD must verify residency training for all residents within 30 days from the point of notification for residents' separation / exit, including residents who did not complete the programme.

Duration of Specialty Training

The training duration must be 60 months, comprising 36 months of Junior Residency and 24 months of Senior Residency.

Maximum Candidature: All residents must complete the training requirements, requisite examinations and obtain their exit certification from JCST not more than 36 months beyond the usual length of their training programme. The total candidature for Diagnostic Radiology is 60 months residency + 36 months candidature.

"Make-up" Training

"Make-up" training must be arranged when residents:

- Exceed days of allowable leave of absence / duration away from training or
- Fail to make satisfactory progress in training.

The duration of make-up training should be decided by Clinical Competency Committee (CCC) and should depend on the duration away from training and/or the time deemed necessary for remediation in areas of deficiency. The CCC should review residents' progress at the end of the "make-up" training period and decide if further training is needed.

Any shortfall in core training requirements must be made up by the stipulated training year and/or before completion of residency training.

Learning Outcomes: Entrustable Professional Activities (EPAs)

Residents must achieve level 5 of the following EPAs by the end of residency training:

	Title
EPA 1	Reporting of Radiographs (X-rays)

Residents must achieve level 4 of the following EPAs by the end of residency training:

	Title
EPA 2	Performing Basic Image-guided Interventional Procedures
EPA 3	Protocoling and Reporting MRI scans
EPA 4	Protocoling and Reporting CT scans
EPA 5	Performing and Reporting Ultrasound Studies
EPA 6	Performing Fluoroscopy Procedures
EPA 7	Reporting of Mammograms (X-rays) and Breast Ultrasound scans

Information on each EPA is provided in here.

Learning Outcomes: Core Competencies, Sub-competencies and Milestones

The programme must integrate the following competencies into the curriculum, and structure the curriculum to support resident attainment of these competencies in the local context.

Residents must demonstrate the following core competencies:

1) Patient care and Procedural Skills

Residents must demonstrate the ability to

- Gather essential and accurate information about the patient
- Counsel patients and family members

- Make informed diagnostic and therapeutic decisions
- Prescribe and perform essential medical procedures
- Provide effective, compassionate and appropriate health management, maintenance, and prevention guidance

2) Medical knowledge

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

3) System-based practice

Residents must demonstrate the ability to:

- Work effectively in various health care delivery settings and systems relevant to their clinical specialty
- Coordinate patient care within the health care system relevant to their clinical specialty
- Incorporate considerations of cost awareness and risk/benefit analysis in patient care
- Advocate for quality patient care and optimal patient care systems
- Work in inter-professional teams to enhance patient safety and improve patient care quality. This includes effective transitions of patient care and structured patient hand-off processes.
- Participate in identifying systems errors and in implementing potential systems solutions

4) Practice-based learning and improvement

Residents must demonstrate a commitment to lifelong learning.

Resident must demonstrate the ability to:

- Investigate and evaluate patient care practices
- Appraise and assimilate scientific evidence
- Improve the practice of medicine
- Identify and perform appropriate learning activities based on learning needs

5) Professionalism

Residents must demonstrate a commitment to professionalism and adherence to ethical principles including the SMC's Ethical Code and Ethical Guidelines (ECEG).

Residents must:

- Demonstrate professional conduct and accountability
- Demonstrate humanism and cultural proficiency
- Maintain emotional, physical and mental health, and pursue continual personal and professional growth

- Demonstrate an understanding of medical ethics and law

6) Interpersonal and communication skills

Residents must demonstrate ability to:

- Effectively exchange information with patients, their families and professional associates.
- Create and sustain a therapeutic relationship with patients and families
- Work effectively as a member or leader of a health care team
- Maintain accurate medical records

Other Competency: Teaching and Supervisory Skills

Residents must demonstrate ability to:

- Teach others
- Supervise others

Learning Outcomes: Others

Residents are required to achieve and maintain competence in the following:

1. Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS)
    - To ensure that residents are able to respond to medical emergencies that occur in the Radiology department. BCLS should be achieved at the beginning of residency. ACLS should be achieved by the end of residency.

2. Moderate sedation
    - To ensure that residents can provide sedation analgesia to those patients who need it for imaging and interventional procedures in the Radiology department. Training should be achieved by the end of residency.

3. Ethics Courses
    - Residents must attend Medical Ethics, Professionalism and Health Law course conducted by Singapore Medical Association (SMA).

4. Geriatric Medicine Modular Course
    - Residents must attend Geriatric Medicine Modular Course by Academy of Medicine Singapore (AMS).

5. Risk Management, Safety and Quality
    - Understand risk of errors or mishaps within one's context and practice. Able to find safe practices to eliminate or mitigation the perceived risk and escalate when uncontrolled risk is observed.
    - Acquire foundational knowledge to perform root cause analysis and quality improvement projects.

- Residents are required to participate in mortality and morbidity rounds.
- Residents are strongly encouraged to participate in quality improvement projects and/or clinical audits.

6. Radiology Informatics and Applied Artificial Intelligence in Radiology
    - Understand the scope of work in radiology informatics.
    - Foundational knowledge in the application of AI in Radiology. Its development, use and potential pitfalls and necessary safeguards to ensure its safe use.

Residents must attend Medical Ethics, Professionalism and Health Law course conducted by Singapore Medical Association (SMA) and Geriatric Medicine Modular Course by Academy of Medicine Singapore (AMS).

Curriculum

The curriculum and detailed syllabus relevant for local practice must be made available in the Residency Programme Handbook and given to the residents at the start of residency.

The PD must provide clear goals and objectives for each component of clinical experience.

Learning Methods and Approaches: Scheduled Didactic and Classroom Sessions

Residents must attend the following didactic sessions:

Didactic session	Frequency	Min Attendance (if any)
National College of Radiologists, Singapore (CRS) Didactics Lecture for R1s to R3s	Weekly	70%
National CRS Didactics Lecture for R4	Fortnightly	70%
Sponsoring Institution (SI) Teachings and Tutorials	Weekly	70%
Subspecialty Interesting Case Rounds or Presentation Sessions / Grand Rounds	Weekly/monthly	At least 10 sessions per calendar year.

Residents are encouraged to attend Radiology related conferences.

1) The educational programme must contain regularly scheduled didactic sessions that enhance and correspond to the residents' fundamental clinical skills education.

2) The curriculum must include at least five hours per week of didactic (classroom and laboratory training) education.

3) There must be interactive conferences and interdepartmental conferences in which both residents and faculty members participate.

4) Residents must be provided with protected time to attend lectures and conferences scheduled by the programme.

   4.1 The programme must provide mechanisms for residents to participate in all scheduled didactic sessions either in person or by electronic means.

5) The didactic curriculum must include:

   5.1 Anatomy, disease processes, imaging, and physiology;
   5.2 Specialty/subspecialty clinical and general content;
   5.3 Topics related to professionalism, physician well-being, diversity, and ethics;
   5.4 Training in the clinical application of medical physics, distributed throughout the educational programme;

      5.4.1 A medical physicist must oversee the development of the physics curriculum.

   5.5 Content integral to the practice of nuclear radiology, including,

      5.5.1 Radiation physics, instrumentation, and radiation biology;

      5.5.2 Radiation protection;

      5.5.3 Mathematics pertaining to use and measurement of radioactivity;

      5.5.4 The chemistry of byproduct material for medical use; and

      5.5.5 Classroom and laboratory training in basic radionuclide handling techniques.

In the event of a protracted outbreak where face-to-face on-site meetings or cross institution movement is restricted, didactic and interactive teaching should be conducted in a safe environment according to prevailing outbreak measures (e.g., decreasing participant numbers or hybrid model). If face-to-face meeting is disallowed, the didactic sessions should be conducted via virtual platforms.

Learning Methods and Approaches: Clinical Experiences

Programmes must include clinical experiences in the following (the maximum period of education in any one of these areas must be 20 months):

a) Nuclear radiology (including PET and nuclear cardiology);
b) Ultrasonography (including obstetrical and vascular ultrasound); and
c) The 10 content areas of breast, cardiac, gastrointestinal, musculoskeletal, neurologic, paediatric, reproductive and endocrine, thoracic, urinary, and vascular radiology.

Residents must have documented supervised experience in interventional procedures, including image-guided biopsies, drainage procedures, angioplasty, embolisation and infusion procedures, and other percutaneous interventional procedures, to include the performance, interpretation, and complications of vascular, interventional, and invasive procedures.

R5 Requirements

a) R5 residents must do four 3-monthly rotations.

b) Each rotation can be in any one of the following subspecialties as follows:

- Musculoskeletal Radiology
- Neuroradiology
- Vascular and Interventional Radiology
- Cardiothoracic Radiology
- Breast Radiology
- Abdominal Radiology
- Paediatric Radiology
- Head and Neck Radiology
- Ultrasonography

c) Residents may do rotations in the same subspecialty area more than once.

d) At least 50% of the clinical time of each rotation should be spent on that specific subspecialty.

e) One of the rotations must be performed in another SI. An additional rotation can be done subject to approval by RAC if supported by the PD of both institutions.

f) Up to 2 rotations may be replaced by research rotation subject to RAC's approval.

g) There should be 'on call' duty during the rotations.

In the event of an outbreak where cross institution movement is limited, alternative elective postings should be arranged while compulsory postings should be shifted to the phases when the restrictions are relaxed.

Learning Methods and Approaches: Scholarly/Teaching Activities

The scholarly activity should include:

a. Participation in Plain X-rays audit.
b. Completion of scholarly activity module (Detailed below)
c. Participation in local conference.

Part 1: Completion of an educational session on research methods. This will be verified by the PD.

Part 2: Four reviews of critically appraised topics (CAT) – For each topic, the resident must

i. Complete the relevant CAT form.
ii. Present the CAT to a group of colleagues including 2 clinical supervisors.
iii. A marking scheme will be developed to assess the resident's review of critically appraised topics. The resident will receive feedback and if needed, repeat the review until it meets expectations.

Part 3: Preparation of a research proposal. The resident must:

i. Complete the relevant research proposal form; and
ii. Present the research proposal to 2 clinical supervisors who will provide feedback.
iii. A marking scheme will be developed to assess the resident's proposal. The resident will receive feedback and if needed, revise the proposal until it meets expectations.

Residents are encouraged to participate in at least 1 quality improvement project and to publish at least 1 scientific paper and/or make a poster/oral presentation.

Learning Methods and Approaches: Documentation of Learning

The programme must provide opportunities for residents to achieve the following.

The resident must perform and log the following:

Reporting of Radiographs (X-rays)	Above 400 by the end of R2 Above 600 by the end of residency
Performing Basic Image-guided Interventional Procedures	At least 15 Peripherally Inserted Central Catheter (PICC) 15 image guided Drainages 15 image guided Biopsies
Protocoling and Reporting MRI scans	Above 200 MRI total of which minimum 20 Brain 30 Spine 30 Musculoskeletal 50 Abdominal and/or Pelvis

Protocoling and Reporting CT scans	Above 800 CT total of which minimum 50 CT Angiogrpahy 20 requiring post processing
Performing and Reporting Ultrasound Studies	Above 200 US performed which should include a total of minimum 10 US thyroid 15 Scrotum 15 Vascular 15 Musculo-Skeletal 15 Paediatrics 15 O&G Above 800 US total reported
Performing Fluoroscopy Procedures	Above 20 cases of fluoroscopy studies including reports
Reporting of Mammograms (X-rays) and Breast Ultrasound scans	Above 300 mammograms total (at least 50 diagnostic) Above 50 US breast reported

Residents must maintain a log of interesting cases with adequate reflection and literature review of the topic.

Summative Assessments

	Summative assessments	
	Clinical, patient-facing, psychomotor skills etc.	Cognitive, written etc.
R5		Summative Portfolio Review based on EPAs and Assessment of scholarly activity (3-part scholarly activity module)
R4		MMed/FRCR Part 2B (Radiology) Oral Viva. Short Case Paper. Rapid Reporting
R3		FRCR Part 2A (Radiology) This comprises two papers of single best answer questions. Each paper has 120 questions. Each paper is to be completed in 180 minutes.
R2		-
R1		First Examination for the Fellowship in Clinical Radiology Two modules: Physics (40 single best answer questions to be answered in 120 minutes) and Anatomy (100 images and associated short answer questions to be answered in 90 minutes)

S/N	**Learning outcomes**	**Summative assessment components**			
		Component a: MCQ	Component b: Rapid reporting	Component c: Film viewing	Component d: Viva
1	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.	FRCR Part 2A ✓		MMed/FRCR ✓	SOEE ✓
2	Medical Knowledge Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social behavioural sciences, as well as the application of this knowledge to patient care.	FRCR Part 1 FRCR Part 2A ✓	MMed/FRCR Part 2B ✓	MMed/FRCR Part 2B ✓	MMed/FRCR Part 2B ✓
3	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-				SOEE ✓

	evaluation and life-long learning.				
4	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.				SOEE ✓
5	Professionalism Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles.				SOEE ✓
6	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.				SOEE ✓