

HONG KONG COLLEGE OF RADIOLOGISTS

GUIDELINES ON BASIC SPECIALIST TRAINING (NUCLEAR MEDICINE)

[This document should be read in conjunction with the Training Regulations and Working Principles for Accreditation of Training Centres and Conduction of Training Programmes.]

1. General Aspects

1.1 In this document the following interpretation applies:

- “Trainer” = a Fellow of the Hong Kong College of Radiologists (Nuclear Medicine), or equivalent
- “Co-trainer” = a Nuclear Medicine physician other than a Fellow of the Hong Kong College of Radiologists, but approved by the Hong Kong College of Radiologists to provide training supervision to trainees under specified conditions. A Co-trainer has the role to supervise trainees on daily training activities but cannot replace the role of Trainers in the overall supervision for trainees throughout the training period. All Co-trainers of the training centre need to be vetted and approved by the College.
- “Trainee” = a medical doctor registered as trainee with the Hong Kong College of Radiologists

1.2 Objectives of Basic Specialist Training:

- (a) To gain comprehensive exposure to a broad spectrum of clinical specialties and the application of imaging modalities.
- (b) To acquire general Nuclear Medicine, basic science and radiation protection knowledge, skill and competence, with supervised responsibility for patient care.
- (c) To develop disciplined habit of reasoning and a logical approach to specific medical problems with respect to Nuclear Medicine.
- (d) To become acquainted with the updated practice and current literature on relevant subjects.
- (e) To be able to communicate with clinical colleagues and render appropriate recommendation on imaging investigation and patient management.
- (f) To be able to advise on the safest and most cost-effective means of arriving at a diagnosis, and to counsel against unnecessary imaging investigation.

1.3 This document will provide guidelines on the following:

- (a) Core knowledge
- (b) Training programme
- (c) Training facilities
- (d) Nuclear Medicine workload
- (e) Accountability

1.4 Training accreditation is in general considered on the basis of standalone training hospital and its satellite facilities, except in special circumstances as defined and approved by the College. A training hospital may be deficient in either clinical specialties or imaging modalities but such deficiencies should only form a minor portion of the workload. The trainees in such hospital need to have complementary rotations or attachments to other centres approved. The training facilities involved under such arrangement should satisfy the basic requirements for training purpose. The training should at all-time be conducted under supervision by accredited Trainer(s) or Co-

trainer(s). The principles of training supervision are delineated in the Working Principles for Accreditation of New Training Centres and Conduction of Training Programmes.

- 1.5 Within an accredited Specialist Training Programme of the College, a trainee may attach to another Specialty of the College to broaden his/her training exposure and to fulfil the training requirements. When individual trainee undergoes the accredited Cross-Specialty training arrangement, he/she should be supervised by the accredited Trainer(s) or Co-trainer(s) of the attached accredited Training Centre under Hong Kong College of Radiologists. The Cross-Specialty training arrangement aims to broaden the exposure of trainees and is not equivalent to training for independent practice in the Cross-Specialty trained subject.

2. Core Knowledge

2.1 Basic sciences:

- (a) *Physical Science*: structure of matter, modes of radioactive decay, particle and photon emissions, and interactions of radiation with matter.
- (b) *Instrumentation*: Nuclear Medicine instrumentation with special emphasis on the gamma cameras (SPECT or SPECT/CT), solid-state detector technology, PET or PET/CT, bone densitometer (DXA), radiation detector collimation, associated electronic instruments and computers, and image production and display.
- (c) *Mathematics, Statistics, and Computer Sciences* including probability distributions, medical decision making, basic aspects of computer structure and function, programming and processing.
- (d) *Radiation Biology and Protection*: biological effects of ionizing radiation, means of reducing radiation exposure, calculation of the radiation dose, evaluation of radiation overexposure, medical management and disposal of radioactive substances and establishment of radiation safety programs.
- (e) *Radiopharmaceuticals*: production of radionuclides and radiotracers, principles of cyclotron, generators, radiochemistry, pharmacokinetics and formation of radiopharmaceuticals, knowledge of radiopharmacy design and the Good Manufacturing Practice (GMP) requirements.
- (f) *Diagnostic Uses of Radionuclides*: clinical indications, technical performance and interpretation of in vivo imaging and function studies using radionuclides; use of gamma cameras and external detectors; physiologic gating techniques; radionuclide-guided surgery techniques; radiotherapy treatment planning using Nuclear Medicine techniques; patient monitoring during intervention studies; understanding of the relationship between Nuclear Medicine procedures and other pertinent imaging modalities such as computed tomography, ultrasonography, and magnetic resonance imaging.
- (g) *Therapeutic Uses of Radionuclides*: patient selection, indication, justification, administration, and therapeutic applications of radiopharmaceuticals and administrable or implantable medical devices, dosimetry, radiation protection and follow-up after therapy.

- (h) *Anatomy, Biochemistry and Physiology*: basic anatomy and physiology relevant to common Nuclear Medicine imaging examinations. There should be a clear understanding of topographic and cross-sectional anatomy as displayed by SPECT/PET imaging. A knowledge of normal variation in anatomy will also be expected.
- 2.2 Pathology and pathophysiology as related to diagnostic and therapeutic Nuclear Medicine procedures.
- 2.3 Current clinical practice.
 - (a) Knowledge of the pharmacological effects of commonly use drugs is essential (e.g. Adenosine, dobutamine, dipyridamole, beta-blockers, nitrates and calcium channel blockers). Prompt recognition of side effects and ability to treat these are essential before the trainee can administer these drugs to the patients.
 - (b) Trainees should be competent in performing resuscitation. Regular attendance of the life-support training courses are encouraged.
 - (c) Skills on haemodynamic and ECG monitoring are essential for safe conduction of examinations.
- 2.4 Medico-legal Aspect: Medico-legal implications of Nuclear Medicine practice, Radiation Ordinance and Local Rules.
- 2.5 Professional attitude and medical ethics.

3. Essential Elements of Training Programme

- 3.1 The College organises centralized Fellowship Basic and Advanced Training Courses, which should be attended by trainees.
- 3.2 The training department should provide relevant teaching in Nuclear Medicine technology, data analysis and clinical Nuclear Medicine to complement the centralised courses.
- 3.3 Hands on practical training for professional skill should be provided at each training department.
- 3.4 The overall minimum trainer-trainee ratio of the training department should be 1:3.
- 3.5 It is recommended that a nominated tutor should provide personal guidance and continuous assessment for a trainee.
- 3.6 Training logbooks are provided to trainees to record training activities received by them.
- 3.7 Tutorial system should be in place and is preferably year round instead of solely preparatory for examinations.
- 3.8 Clinical Meetings
 - (a) Attendance of clinical meeting is an important aspect of training in clinical management of clinical problems: *Attendance of at least 1 clinical meeting per month.*
 - (b) Case presentation by trainee provides good training.

- (c) Trainees are encouraged to attend clinical meeting and the training department may take note of this point in the scheduling of the meeting.
 - (d) Clinical meeting attendance and case presentation should be recorded in the logbooks.
 - (e) Clinical meeting should take place in an environment that encourages the interchange of knowledge and experience among the participating disciplines.
- 3.9 Regular interaction between trainee and immediate supervisor is essential to prompt timely modification of individual training programme. This should be documented at regular intervals in the trainee's logbook, and significant events should be brought to the attention of the College.
- 3.10 There must be regular written evaluation of the trainees, to verify that appropriate training has been undertaken during the specified period under the supervision of trainers, and to evaluate the knowledge gained and the level achieved.
- 3.11 The following are some of the measures of the quality of a training programme:
- (a) Performance of a department's trainees in the College examinations
 - (b) Research and audit projects
 - (c) Publication in professional literature
 - (d) Lectures and presentation at local, regional or international professional conventions.
 - (e) Contribution to College, regional or international professional activities
 - (f) Output of Nuclear Medicine physicians subsequently becoming consultants or senior Nuclear Medicine physicians in the territory.
- 3.12 Part of the training can be conducted in satellite facilities of the accredited training centre. The requirements are delineated in Section 5 of the Working Principles for Accreditation of Training Centres and Conduction of Training Programmes.
- 3.13 Rotation of trainees among training departments to broaden the clinical exposure of the trainees is advisable.
- 3.14 Trainees may apply for recognition of external training activities as part of accredited training. The requirements are delineated in the Working Principles for Accreditation of Training Centres and Conduction of Training Programmes. A list of pre-approved external training activities would be provided by College to Training Centres on regular basis. It can also be obtained from College upon written request.

4. Essential Elements of Training Facilities

- 4.1 The hospital administration of the training centre should be supportive of training in Nuclear Medicine.
- 4.2 A comprehensive scope of clinical services should be available in the hospital and its satellite facilities.
- 4.3 A full range of Nuclear Medicine imaging techniques should be available in the hospital and its satellite facilities. The training department should have at least two gamma cameras with SPECT capabilities, at least one of which is SPECT/CT. It is desirable that the department has additional Nuclear Medicine equipment and facilities, such as

PET/CT scanner, bone densitometer, radiopharmaceutical preparation laboratory, radioimmunoassay laboratory and cell labelling facilities.

- 4.4 The training department must provide adequate space, equipment and other pertinent facilities to ensure an effective educational experience for the trainees in nuclear medicine, including
- (a) Departmental library with current books and journals on Nuclear Medicine, either in hard copies or online format, readily available during off-hours and weekends.
 - (b) Film museum, and related training materials like videotapes, CDR, slides, computer programs etc. The teaching files should be indexed, coded and currently maintained.
 - (c) Study room
 - (d) Internet access to online Nuclear Medicine resources such as journals, image libraries & case studies.
- 4.5 Training centres should have a radiology coding and information system (e.g. the RIS of Hospital Authority of Hong Kong). The person(s) who report, endorse and supervise the reporting are clearly indicated on the electronic report and traceable in order to facilitate the auditing of trainee performance. For those centres that do not use the HA RIS coding system, comparable and compatible coding system must be available and a copy submitted to the College before being considered eligible as a Nuclear Medicine training centre. A mechanism of conversion of the codes may be necessary for the record of caseload.
- 4.6 The trainees must have ready access to a major medical library.
- 4.7 There should be ongoing research, audit and teaching activities in a training department.
- 4.8 Medical physicist support should be available to oversee the following areas for the department, including
- (a) Radiation safety and protection
 - (b) Equipment quality assurance
 - (c) Information technology

5. Nuclear Medicine Workload

- 5.1 A minimum amount of regular workload is necessary for a trainee to be exposed to the spectrum of normal variants and pathology, and to have sufficient hands-on experience. At least 2000 Nuclear Medicine procedures, excluding bone densitometry, should be performed in the training centre or its satellite facilities each year. These should cover a wide range of examination categories to provide the trainee with the required workload as specified in 5.2.
- 5.2 It is recommended that at least 3000 procedures must be supervised and performed/reported by the trainee during Basic Specialist Training, and the quality of these audited. These should include a wide range of pathology, and include paediatric studies. The minimum number for each examination category is as follows:

Examination Category	RIS Coding	Requirement*
Central nervous system	9010-9099	20
Cardiovascular system	9110-9170, 9180-9199	450
Endocrine system	9220-9299	150
Gastrointestinal & Hepatobiliary systems	9301-9350, 9370-9399	30
Urogenital system	9420-9499	200
Haematopoietic & lymphatic systems	9351-9360, 9510-9599, 9171	20
Infection, inflammation & Oncology	9610-9799	150
Pulmonary system	9810-9899	30
Musculoskeletal system	9910-9950, 9999	600
Bone densitometry	9980-9983	500
Radionuclide therapy	9T21-9T91	40
PET/CT	9P13-9P49, 9C13-9C49	250
* Including at least 150 procedures performed in paediatric patients		

5.3 Training centres are reminded that the minimum number of performance of examinations under supervision serves only as reference in evaluating whether the trainees are considered competent of performing that particular examination. In light of wide spectrum of diversified complexity of Nuclear Medicine examinations in clinical situations, the Training Centres should exercise stringent monitoring of performance of their trainees and ensure that they can have ready access to trainers or co-trainers for consultation whenever needed.

5.4 Report Format & Training Record System

A trainee could perform Nuclear Medicine examinations and report independently after fulfilling at least 50% of the training requirements for each respective category of the examinations as stipulated in the above table AND his / her competence level has attained the required standards as determined by the Training Head in the performance appraisal report. Examination reports should be signed by the trainee if the cases are performed on his / her own independently. The report should be endorsed by the Trainer or Co-trainer and the trainee if the case is performed by the trainee under direct supervision. For situations in which reporting or performing of examinations cannot be accurately reflected via the standard method (e.g. RIS system of HA), trainees may use separate manual log with counter-signage by Trainers or Co-trainers.

6. Accountability of the Training Department

6.1 It is advisable that the Training Head is not the same person as the Administrative Head of the Department.

6.2 Accountability of the Training Head:

- (a) To initiate application for training accreditation by the College, with submission of the required data.

- (b) To manage the training department and be responsible for the supervised training provided in the department in accordance with the training regulations and guidelines.
- (c) To report immediately to the College any significant discrepancy from the status on accreditation, in respect of training manpower, facilities and workload that may have occurred or are expected to occur. All training centres are required to regularly notify the College on the updated number of trainers, co-trainers and trainees, and any change of their status. Suboptimal number of trainers and co-trainers, or failure to timely report to College for important change of status of trainers and co-trainers might prompt the College to actively review the accreditation status of a training centre.
- (d) To initiate timely consultation with the College on matters related to training, especially on major change of training provision which may risk on jeopardizing the quality of training.
- (e) To advance the views of the College and to disseminate to the trainees relevant information from the College.
- (f) To facilitate the trainees to attend training and educational activities.
- (g) To provide annual return to the College on the status of trainers, co-trainers and trainees, and the assessment forms of the trainees in the department.
- (h) To meet the trainees regularly, to be able to evaluate and provide advice to the trainees in Nuclear Medicine.
- (i) To answer trainees for questions relating to training, and channel the questions to College for consultation if necessary.
- (j) To oversee the system of evaluation and monitoring on the level of supervision of trainees in different Nuclear Medicine examinations.

6.3 Accountability of the **Trainee**:

- (a) To register as a trainee with the College on entry into the training system.
- (b) To be aware of the scope, programme, facilities, workload and other aspects of training required in Nuclear Medicine.
- (c) To participate in the training courses organised by the College, and the training activities held at the training department.
- (d) To participate in and contribute to scientific and other activities organised by the College.
- (e) To enter the training records in the logbooks regularly. The logbooks from all trainees would be reviewed at three fixed check points, namely after basic training (i.e. after passing Final (Part II) Fellowship Examination), after the first year of higher training and at the end of higher training (i.e. before Exit Assessment), by College to verify that appropriate training had been undertaken during the specified period under supervision of trainers.
- (f) To interact with the trainers during the regular appraisal sessions.
- (g) To bring to the notice of the Training Head, and if necessary the College, of any deficiency in the training program for improvement at the specific training department.
- (h) To prepare for the examinations and assessments of training at different levels.
- (i) To be fully aware of the Guide on Good Medical Practice for Radiologists by the College.

7. Radiology Training

- 7.1 Trainees are required to have consecutive 3-month rotation to an accredited Radiology training centre (with emphasis on CT and MRI) within the first year of Nuclear Medicine training. Trainees are then required to fulfill the remaining 6-month equivalent Radiology training in the rest of the Basic Specialist Training period.

The minimal workload of Radiology training in the Basic Specialist Training is as follows:

Examination	RIS Coding	Requirement
CT	4101 - 4499	1200
MRI	8101 - 8699	100

8. Additional Notes

- 8.1 Trainees are also required to have adequate training on radionuclide therapy (e.g. I-131 thyroid treatment, I-131 MIBG therapy, radiosynovectomy, etc). Elective rotation to other accredited departments for such training has to be arranged if necessary. Prior approval from the College has to be obtained if rotation to local non-accredited or overseas departments for such training is deemed necessary.
- 8.2 Trainees should be familiarized with the background knowledge and clinical applications of cyclotron and radiopharmaceuticals (NM and PET tracers).

*Last version endorsed by HKAM Council on 16 January 2020 and effective from 1 January 2020
Revised version endorsed by HKAM Council on 9 December 2021 and effective from 1 July 2022*