



**SPECIALTY TRAINING CURRICULUM**

**FOR**

**CLINICAL RADIOLOGY**

31 December 2013

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# 1 INTRODUCTION

The Radiology Curriculum sets out the framework for educational progression that will support professional development throughout Specialty Training in Clinical Radiology. The curriculum defines the process of training and the competences needed for the successful completion of training in Clinical Radiology. The aim is to ensure that trainees are fully competent to provide a high quality service at consultant level in the NHS. The curriculum has been designed in line with the GMC Standards for Curricula and Assessment Systems (July 2008, updated 2010). There are sections detailing the planning, content, delivery, outcomes and review of the curriculum. With respect to the content, generic, professional and specialty specific areas are included.

## **Good Medical Practice**

The generic syllabus content is based on Good Medical Practice (GMP) 2006 (updated 2013), as outlined by the General Medical Council (GMC). Radiology trainees will have a chance to show both the confidence and competences necessary to develop increasing levels of expertise in their subsequent clinical and professional practice.

## **Outcomes of radiology training**

This programme will allow radiologists in training to apply their knowledge and skills in the workplace and demonstrate improving performance to the level that will satisfy the needs of the GMC for completion of training and fulfil the requirements for a Certificate of Completion of Training in Clinical Radiology, making them eligible to apply for entry to the GMC Specialist Register and then to take up consultant posts.

## **How to use this Curriculum**

This curriculum is intended to be used by radiologists in training, those delivering their education and those responsible for quality assurance (national), quality management (deanery) and quality control (local education provider).

**It is strongly recommended that the section *How to use this Curriculum* is read thoroughly by all.**

## **Key messages of the Curriculum**

### **Patient Safety**

- Must be placed at the centre of healthcare
- High quality patient care depends, among other aspects of practice, on effective multidisciplinary team working
- Learning in, and from, clinical practice is the most effective way for professionals to develop much of their expertise.

### **Personal development**

- Radiologists are committed to lifelong learning in, and from, the practice of radiology in the clinical environment and through repeated clinical experience. Radiology trainees will be expected to develop critical thinking and professional judgement, especially where there is clinical uncertainty
- Every clinical experience is a learning opportunity and should be reflected upon from the perspective of developing skills, acquiring clinical/radiological acumen

and improving performance. By doing this, an individual demonstrates their commitment to lifelong learning and continuing professional development.

- Doctors must continuously work to improve performance, i.e. improve what they actually do as distinct from what they are capable of doing.

### **Assessment**

The emphasis of radiology training is on developing radiologists who are safe in their judgements, patient-focused and accountable to the public for delivering evidence based, effective medical care. The concept of "competent" requires the integration of different types of knowledge, skills and attitude in a pressurised, but supervised, clinical environment.

Workplace based assessments (WpBA) will take place at regular intervals throughout training. The assessment tools are designed to help doctors develop and improve their performance. Feedback is a key factor to enable this to happen.

Throughout their careers, doctors should strive to improve their performance to ensure their progression from competence, through proficiency, to expertise. The vast majority of radiology trainees will have no difficulty with their assessments. When problems are identified, the trainee will be encouraged to work to find solutions with the support of their clinical and educational supervisors.

### **ePortfolio**

The ePortfolio is a record of a trainee's progress and development through radiology training. It provides a record of objective evidence of competence to work in a range of clinical settings and a record of satisfactory performance. This means that ePortfolio completion contributes to the end of year report, annual review of competence progression (ARCP) and may also be used in interviews. Successful completion of the curriculum requires the achievement of competence in a variety of domains relating to generic medical practice, radiological and clinical practice. The assessments of these competences are recorded in the ePortfolio.

## **1.1 AIMS AND VALUES**

### **Aims**

The over-arching aims of the curriculum are to represent a distillation of the values and attributes attainable by radiologists passing through training programmes implementing and embracing the educational potential of clinical radiology. These can be summarised as follows:

- Sufficient knowledge and skills to undertake the practice of clinical radiology at consultant level.
- A professional attitude to all aspects of clinical practice, which places good conduct at its centre.
- Sound judgement through intelligent application of knowledge.
- A sense of team-working within all spheres of practice.
- An insightful approach: knowing individual/collective strengths and limitations, when to be decisive and when to seek help.
- An enthusiasm for knowledge and understanding to support lifelong learning.
- A reflective attitude allowing accurate self-assessment and learning from practice.
- The abilities necessary to provide improved patient care.

### **Values**

Set out below are the values considered to be of importance in the teaching, learning and practice of clinical radiology. In clinical practice, there is little or no distinction between the sub-headings of practical, educational and professional values. The sub-division is simply for emphasis and clarity.

#### **Practice Values for Clinical Radiology**

- A recognition that clinical radiology is not merely a technical specialty but a specialty of medical practice concerned with diagnosing and treating patients and, therefore, requires practitioners with all the attributes of a good doctor.
- Clinical radiology has good conduct at the heart of its practice.
- Through sound judgement radiological practice can improve patient management and outcome.
- Good communication is an essential component of sound practice.
- Clinical radiology is a dynamic medical specialty that must work with other medical and surgical specialties to respond to the needs of patients.
- Clinical radiology relies on a multi-professional team and so radiologists should work with other healthcare professionals to put the needs of the patient above their own.
- As a medical practitioner, clinical radiologists have a responsibility to question the decisions of others if they believe it undermines the best care of the patient.

### **Educational Values for Clinical Radiology**

- Recognition of the importance of nurturing a professional attitude (see below) to complement the knowledge and skills required for good practice.
- Teaching that recognises the importance of understanding in the creation of knowledge.
- Knowledge should not be assumed.
- The need and desire to establish educational partnerships.
- Flexibility to tailor teaching to the needs of the learner as agreed between both teacher and learner.
- Recognition of the need for a variety of educational methods to suit the learner and the context of learning.
- Wherever practical, set teaching in the practice setting and teach theory within practice.
- Establish early learner motivation towards an attitude of self-sufficient life-long learning and development.
- Recognition of the educational potential of reflective practice with self, peers and teachers as a means to constructive self criticality.
- Recognition of the multi-faceted nature of radiological practice so exposing learners to the many special interests within clinical radiology as well as those that support it, such as research, audit, quality improvement, management and teaching.
- Understanding and recognition that knowledge is not merely acquired for perpetuity but is a developmental process of increasing sophistication.
- A desire to commit to the dynamic nature of radiological practice and its teaching, so seeing the curriculum as an evolutionary document.
- Recognition that hierarchy can be detrimental to education.

### **Professional Values for Clinical Radiology:**

- To be accountable for individual/collective actions.
- Develop a clear understanding of individual abilities and limitations.
- Be honest in all aspects of radiological practice even, and especially, in times of adversity.
- To strive to develop and practise sound judgment.
- Show respect towards patients and colleagues.
- Maintain individual skills, knowledge and values throughout one's career

## **1.2 CURRICULUM RATIONALE**

Radiology trainees are developing professionals and need to deepen and broaden their understanding and expertise. This means

- revisiting clinical and professional practice, and studying at increasingly complex levels
- practising with decreasing supervision
- recognising that levels of expertise generally increase with practice and reflection.

In order to become effective, clinical radiologists must improve the diagnosis and management of their patients. To do this, radiology trainees need a broad knowledge base and extensive experience. The curriculum needs to take account of the fact that "common things commonly occur" and that these need to be within the repertoire of all radiologists. Uncommon diagnoses are possible and need to be suspected when there is something unusual in the patient's presentation. These higher level competences are addressed within level 1 and 2 training.

As with all doctors, radiology trainees should never stop learning and continuing their professional development. They should continue to refine their clinical skills and techniques and the quality of their interactions with others. This includes encouraging self care and shared decision making with patients, relatives and colleagues. It is probably as important for them to understand their personal style, assumptions and beliefs (and to change them when appropriate), as it is to develop their procedural and clinical/radiological skills.

Radiology trainees are responsible for their own learning. At the same time, they must understand the needs of the patient and of the organisation in which they work. They should understand the complexities, constraints and opportunities they find in their practice, and be able to choose how to make best use of these. They also need to understand that, as well as engaging in more formal educational activities, they learn by working with other team members. They must learn how to contribute to the safe practice of radiology.

Good educational practice acknowledges the private and public aspects of professional development, and gives due importance to the key relationships that inform professional development. Effective learners will achieve their aims, acknowledging that who they are and what they believe affects what they do.

Effective educational practice will help radiology trainees to understand the relationship between theory and reality, which will enable them to exercise better judgement in complex situations. They will also be encouraged to understand other roles within the team and show how they can adapt and collaborate in emergency situations. They will need to become aware of the different perspectives and expertise that can improve problem solving, clinical reasoning, patient management and decision-making.

Acquiring expertise that can be adapted to new situations depends on the development of clinical /radiological and ethical reasoning and professional judgement. Much learning occurs in teams and much knowledge and expertise is found in groups rather than in individuals. This strengthens the principle that learning in Clinical Radiology should take place in team-based practice. Expertise is more than knowledge or a tool kit of skills. The radiology trainee will learn similar skills in different settings, facilitating the development of transferable skills.

### **1.3 ENTRY AND INDICATIVE TRAINING**

#### **Summary of Standard Training for a CCT in Clinical Radiology:**

- Primary Medical Qualification
- 2 Years of Foundation Years Training (FY 1 and 2) or equivalent and, for some, additional experience in other programmes (medicine, surgery, etc)
- Core Radiology Training as a specialty registrar (ST1-3) over an indicative period of three years followed by:
- Advanced (special interest) Radiology Training (ST 4-5) over an indicative period of two years

#### **Alternative Entry Points**

Those trainees who move into a specialty training programme from a Locum Appointment – Training (LAT) post or a Fixed Term Training Post will be eligible to have the earlier post and training accepted towards their CCT, provided that the original post has been approved by GMC, that their training is relevant to the CCT programme in clinical radiology and that progress and performance have been satisfactory. Approval to count previous LAT training must be agreed by the College at the start of the specialty training programme. Retrospective approval once training has started will not be allowed by the GMC.

It is a legal requirement that a CCT can be awarded only to a person who has completed an entire course of training approved by the GMC. Those with training and/or qualifications from outside the UK will usually be required to complete the full duration of the CCT training programme, including success in all parts of the FRCR Examination if they wish to acquire a CCT in clinical radiology. Appointment panels may take account of previous experience that has not been prospectively approved by the GMC. Trainees who meet the required criteria are not entitled to be awarded a CCT, but apply for specialist registration through the Certificate of Eligibility for Specialist Registration combined programme (CESR CP) route. Trainees may be appointed above ST1 and must complete the rest of their training as though a CCT trainee, by following the training assessment blueprint at point of entry.

### **1.4 ENROLMENT WITH THE ROYAL COLLEGE OF RADIOLOGISTS**

Trainees are required to enrol with the RCR, and become trainee members of the College, prior to the commencement of their training. Trainees are required to maintain College membership, including the full payment of all applicable fees, through training for the RCR to be able to recommend them as being eligible for award of a CCT.

### **1.5 DURATION OF TRAINING**

Although this curriculum is competency based, the duration of training must meet the European minimum for full-time specialty training, adjusted accordingly for flexible training (EU directive 2005/36/EC). At the time of writing this is four years but this is expected to increase to five years shortly. However, the RCR advises that the indicative duration of training from entry into the specialty (ST1) to completion will be five years in full time training.

Interventional radiology Level 1 and 2 procedural skills are included in the “General and Non-vascular intervention” and “Vascular Radiology” sections of this curriculum. It is therefore possible that trainees can acquire a CCT in Clinical Radiology in five years of training, without formal sub-specialty recognition in IR, and still have a strong portfolio of interventional skills. The IR sub-specialty curriculum, however, offers an alternative option for those who wish to specialise in IR, with an additional year of training. The IR sub-specialty also encompasses interventional neuroradiology.

## **1.6 FLEXIBLE TRAINING**

Trainees who are unable to work full-time are entitled to opt for flexible training programmes at the discretion of their local deanery.

- Less than full time training (LTFT) shall meet the same requirements as full-time training, from which it will differ only in the possibility of limiting participation in medical activities.
- The competent authorities shall ensure that the total duration and quality of part-time training of specialists are not less than those of full-time trainees.

The above provisions must be adhered to. Less than full time trainees should undertake a pro rata share of the out-of-hours duties (including on-call and other out-of-hours commitments) required of their full-time colleagues in the same programme and at the equivalent stage.

LTFT Training should comply with current guidance from the GMC, extracts of which are reproduced below:

- Under normal circumstances the minimum percentage for LTFT should be 50%.
- In exceptional individual circumstances, trainees may be allowed to undertake training at less than 50% of full time. These circumstances should be considered by the trainee's deanery and should have the support of the postgraduate dean or their deputy. A placement at less than 50% of full time should be for a maximum of 12 months and should be subject to regular review to ensure appropriate career progression during the time.
- No trainee should undertake a placement at less than 20% of full time.

Funding for flexible trainees is from deaneries and these posts are not supernumerary.

## **1.7 TIME OUT OF TRAINING**

The General Medical Council has determined that, within each 12 month period where a trainee has been absent for a total of 14 days or more (when a trainee would normally be at work), such absence will trigger a review of whether the trainee needs to have their CCT date extended. The absence includes all forms of absence such as sickness, maternity, compassionate paid/unpaid leave etc., other than study or annual leave or prospectively approved Out of Programme Training/ Research. Absence will be monitored at ARCP.

### **Notification of Absences from Training**

Such absences must be notified to the Training Office of the Royal College of Radiologists as soon as is feasible, preferably in advance. The Training Office will provide guidance to the trainee and his/her training programme director about the effect of the absence upon the trainee's expected CCT.

### **Acting-up as a consultant**

A trainee who has passed the Final FRCR Examination may spend up to three months, during the final year of specialist training, "acting-up" as a consultant without affecting his/her expected CCT date, provided that a consultant supervisor is identified for the post, prospective approval has been obtained from the College's Training Office, and satisfactory progress is made. Trainees and deaneries do not need to seek approval from the GMC as this training has been pre-approved across the UK.

## **1.8 OUT OF PROGRAMME ACTIVITIES**

### **RESEARCH**

Trainees who wish to acquire extensive research competences, in addition to those specified in this curriculum, may undertake a research project as an ideal way of obtaining those competences. Options to be considered include taking time out of programme to complete a specified project or research degree. Applications to research bodies, the deanery and the College will need to be made by the trainee. The deanery will make an application to the GMC for approval of the out of programme research. All applications for out of programme research must be prospectively approved.

Funding will need to be identified for the duration of the research period. A maximum period of three years out of programme is allowed. During this period trainees will be able to gain recognition of continuing clinical competences. As such the RCR may recognise up to a maximum of 12 months clinical training during this time.

All trainees are required to demonstrate an understanding of research methodology and critical appraisal linked to clinical practice. There are various ways in which this can be demonstrated. Trainees should consider undertaking a research project during training. Alternatively, trainees should, with their educational supervisors, develop a research question and a protocol as a theoretical exercise. All trainees should develop their critical appraisal skills and regularly appraise and discuss current research papers – for example as part of regular journal clubs.

### **TRAINING**

Trainees wishing to acquire additional experience not available within their training programme, such as for a Fellowship post, should obtain approval in advance from the trainee's deanery and the College's Training Office. It should be noted that any time spent outside the trainee's own training programme that is to be counted towards his/her CCT, as Out of Programme Training (OOPT), will require prospective approval to be obtained from the GMC by the trainee's deanery. Further guidance can be found on the College's website.

## 1.9 HOW TO USE THE CURRICULUM

### TRAINEE RADIOLOGIST

To make the most of the opportunities available in radiology training you need to have an appreciation of how the curriculum works. The curriculum assumes that all doctors will be proactive and organised in managing their continuing education. The first steps are to understand

- The purpose of radiology training  
Please read the *Introduction* and *Aims and Values* sections.
- How you will be supported educationally  
Read the sections on *Support for Learning, Assessment and Feedback* and *Appraisal*. Understand the system of workplace based learning and other educational opportunities that should be made available to you.
- Radiology training  
Most training programmes offer a variety of training opportunities badged according to imaging modality and/or body systems. Not every trainee is expected to rotate through every attachment. Trainees, educational supervisors and training programme directors should compile rotations that cover the core and, wherever possible, reflect each trainee's special interests. Trainees will have the opportunity to cover many aspects of the neurology and oncology curriculum during other attachments, such as CT, MR and ultrasound, or vice versa.
- Focussed individualised training (FIT)  
Trainees with a particular area of special interest, on entering training in radiology, following discussion with their training programme director, can be offered focussed individualised training (FIT), if suitable and educationally deliverable. This will ensure that they can sample their preferred area early in training to confirm/affirm their interest and ability. In addition, they can, where possible, spend time in their special interest area during each rotation (eg one or two sessions a week).
- What you are expected to achieve  
Review the *Syllabus and Competences* section, looking at the main domains/headings applied to groups of competences in relation to the relevant presentations and diagnoses. Get an idea of what you should be aiming to achieve over the programme. You should distinguish between **core, level 1 and level 2** competence.
- How your competence will be assessed in the workplace  
Competency assessment in radiology training is outlined in the *Support for Learning, Supervision and Feedback* and *Assessment* sections. You should familiarise yourself with this especially the ethos of reflective learning and feedback.
- Workplace based assessments (WpBA)  
Participation in workplace based assessment (WpBA) is mandatory. A minimum number of WpBA is specified in order to progress. It is expected that most trainees will undergo many more assessments demonstrating their engagement with reflective learning in practice. Workplace based assessors will include all those individuals involved in the delivery of training. This includes consultants,

senior trainees and advanced radiographic/sonographic practitioners. It is expected that at least 50% of WpBAs will be undertaken with consultants. Each WpBA should also be considered developmental and an opportunity for learning and feedback. WpBAs are formative assessments – assessments for learning – principally intended to support learning by providing feedback to trainees and helping to identify strengths and areas for development. The pattern of evidence from a set of WPBAs will, however, be used as one source of evidence for an ARCP panel to consider when making judgements about a trainee's progression

- How to record your progress in the ePortfolio  
You should enrol with the Royal College of Radiologists prior to the commencement of your training. This will, amongst other things, allow you access to your ePortfolio. You need to become familiar with the ePortfolio as a record of learning.
- Reflective Practice  
Radiologists should learn from both their positive and negative experiences, demonstrate consistent good performance and record their achievements and concerns in their ePortfolio. Reflective practice has the potential for demonstrating evidence of on-going self appraisal of aspects of clinical practice, not currently assessed in the syllabus.

#### Educational Supervision

At the start of your specialty training, and of every rotation to a new education provider, there should be a local induction, which further introduces the programme and how it is delivered and assessed by the education provider. There should be further induction sessions at the start of each placement.

At the first Educational Supervision session, you may wish to discuss aspects of curriculum delivery with your educational supervisor. These might include

- known strengths from undergraduate and early clinical training
- particular areas of interest to you
- any potential weaknesses that you feel may need addressing.

You should agree to follow the appraisal system and associated timelines for ongoing educational supervision, as well as undertaking the required assessments. This is signed off by both trainee and educational supervisor in the form of an educational agreement.

#### Core, Level 1 and Level 2 competences

The curriculum recognises **core, level 1 and level 2** competences. It is expected that you will acquire more competences as you progress through training. It is important to monitor the progression and the achievement of competences from the outset of training. Trainees should familiarise themselves with the ARCP decision aid at the start of training so they are aware of what is required of them throughout each stage of their training. See the *Assessment* and *ARCP* sections below.

Each trainee should strive to achieve as highly as possible but it is recognised that learning occurs at different rates in each individual. Many trainees are expected to achieve level 1 or 2 in some areas during core training. ***It is not expected that every trainee acquires every competence or covers every area.***

1. Core training (indicative Years 1-3)

All trainees are expected to reach core competence, as this reflects what is likely to be required by any radiologist performing acute imaging. Core competence must be maintained until the end of training.

2. Higher training (indicative Years 4-5)

Levels 1 and 2 competence indicate the greater degree of expertise to be achieved by those intending to practice with multiple or mono-special interest areas.

Level 1

All radiologists would probably hold level 1 in at least two areas. They would be able to practice as a consultant with a special interest in these areas. Radiologists with other specialist interests would be expected to consult them for advice within their disciplines.

Level 2

A radiologist with level 2 competence would be likely to be a mono-specialist and an expert in their field. He/she is likely to be consulted by radiologists within the same discipline.

Levels of Competence

It is important to note that within this curriculum the concept of “levels” applies to subject areas within which trainees specialise, mainly during higher training. These levels do not relate to the capacity for independent practice to be demonstrated in relation to individual skills. The relevant workplace-based assessments (Rad-DOPS, mini-IPX) allow for the recording of observed competence in specific procedural or reporting techniques. These use four stages of competence, which vary in detail according to the assessment, but which can be summarised as:

- Trainee requires additional support and supervision
- Trainee requires direct supervision
- Trainee requires minimal/indirect supervision
- Trainee requires very little/no senior input and is able to practise independently

To be recognised as being at Level 1 or 2 in an area of special interest it is expected that trainees will be able to operate at the top of this scale, i.e. independent practice, across that section of the syllabus.

Requirement for CCT

In order to be awarded a CCT in Clinical Radiology a trainee must have completed Level 2 competences in one special interest area or Level 1 competences in the equivalent of two or more areas, as well as maintaining core competence across the curriculum. This will be tracked in the ePortfolio, confirmed by the educational supervisor in their annual trainee report and ratified by the ARCP panel before sign off as ARCP 6.

When engaged in reflection, formal assessment or self assessment, it is recommended that you again refer to the framework of competences to check your progress against the range of competences that you are expected to achieve.

If you experience any difficulties with this, your educational and clinical supervisors are there to help you.

## **TRAINER**

Please read the *Introduction* and *How to use the curriculum: Trainee Radiologist* sections.

A definition of training roles can be found on the RCR website.

Your roles will vary and may involve teaching and making available other learning opportunities in the workplace, contributing to other forms of learning, providing workplace based assessments and clinical supervision, providing educational supervision and ensuring patient safety within the learning environment.

You should be supported in your role by your Local Education Provider (LEP) and/or your Radiology School and should have received training for all the different roles that contribute to postgraduate education. There should be adequate time within your job plan to carry out your agreed postgraduate training roles to a high quality standard.

## **LEARNING IN THE RADIOLOGY DEPARTMENT**

### Overview

The main themes of the curriculum are core competency (Years 1-3), and development of special interest (Years 4 and 5). Satisfactory performance in professional practice will be expected throughout. Formative workplace based assessments will enable overall competency and performance to be judged and will be the basis of much of the assessment of generic skills and competences such as good medical practice, clinical care, professionalism and leadership. Other learning environments, such as e-learning, textbooks, journals, short courses and simulation activities, should also be used.

During a radiological attachment, the trainee radiologist should select topics on which to be assessed from the relevant list of presentations/diagnoses contained within the syllabus. A range of assessment tools will be used. The trainee radiologist and clinical or educational supervisor should ensure that a wide selection of core problems is formally assessed over the course of each attachment. More details about the assessment methodology appear in the *Support for Learning, Supervision and Feedback* and *Assessment* sections.

### Practical procedures

Radiologists perform many practical procedures during their day to day work. Some of these relate to imaging techniques such as ultrasound; others are peripheral to the technique, such as insertion of intravenous cannulae, nasogastric tubes etc. Other procedures are interventions or therapies in their own right.

Throughout the curriculum, interventions are included in the General and Non Vascular Intervention section. Trainees and trainers should refer to this section to find details of core and levels 1 and 2 general and non-vascular intervention competences.

## **1.10 THE SYLLABUS IN PRACTICE**

The syllabus sets out what radiologists need to learn in order to be able to manage a wide and varied caseload and to work adaptively in healthcare teams. These competences may be acquired in a variety of radiological settings. Radiology trainees should emerge with the professional qualities, understanding, critical perspective and ability to reflect on and in practice.

Throughout their training, it is important that radiology trainees should be encouraged to reflect on decisions, management plans and actions taken. In discussion with their supervisors, they will be expected to discuss the thinking and reasoning behind them.

At all times radiology trainees will:

- practise within their competence level
- practise in accordance with the standards expected of them in the unit in which they are placed
- always refer to more experienced radiology colleagues/teachers/mentors when they are uncertain as to the best management of a particular patient
- practise according to prevailing professional standards and requirements.

### **Outcomes**

The outcomes and competences described for core training should be achieved by the end of the third year of training. The appropriate level 1 and 2 outcomes and competences should be achieved by the end of the fifth year of training. A key feature of the clinical radiology curriculum is that all radiology trainees must develop competences at an increasingly higher level during the course of their training. Radiology trainees will need to find out about the specific learning opportunities offered by the various specialty placements.

Evidence of the radiology trainee's learning, development and achievements will be recorded in the ePortfolio. Further information and declaration forms for probity, professional behaviour and personal health can be found in the ePortfolio.

The following section outlines what needs to be learnt in the Clinical Radiology Training Programme. Throughout this section, the terms "patient" or "carer" should be understood to mean "patient", "patient and parent", "guardian", "carer", and/or "supporter" or "advocate" as appropriate in the context.

## 2 SYLLABUS AND COMPETENCES

### 2.1 ASSESSMENT METHODS/GOOD MEDICAL PRACTICE MAPPING

In the tables within the curriculum, the "assessment methods" shown are those that are appropriate for that topic and the ones that could be used to assess each competency. It is not expected that all competences will be assessed; where they are assessed, it is not expected that every method will be used. See the *Assessment* and *ARCP* sections.

"GMP" defines which of the four domains of the Good Medical Practice Framework for Appraisal and Assessment are addressed by each competency. See the table below.

The following is a key for both the summative and formative assessment methods, as well as the GMP domains as they are mapped to the competencies within the syllabus. The assessment methods include all the currently available summative (examination based) and formative (workplace based) assessments available in clinical radiology. Further details of the methodology and utilisation of these methods can be found in the *Assessment* section.

#### Assessment Methods Key

1	First FRCR Examination	7	Rad-DOPS
2	Final FRCR Part A Examination	8	MSF
3	Final FRCR Part B Examination: rapid reporting session component	9	Audit Assessment
4	Final FRCR Part B Examination: reporting session component	10	Teaching Observation
5	Final FRCR Part B Examination: oral examinations	11	MDT Assessment Tool
6	Mini – IPX		

#### Domains of Good Medical Practice (GMP) Key

1	Knowledge, Skills and Performance	3	Communication, Partnership and Teamwork
2	Safety and Quality	4	Maintaining Trust

## **2.2 SCIENTIFIC BASIS OF IMAGING**

### **1 INTRODUCTION**

- 1.1 The purpose of this section of the syllabus is to provide those undertaking specialty training in clinical radiology with appropriate knowledge of the physical, cellular and molecular principles that underpin diagnostic medical imaging. When linked with other training in clinical radiology, this should lead to the safe and effective application of diagnostic imaging for the benefit of patients. It should also provide a basic awareness of developments relevant to future practice and research.
- 1.2 It is intended that this syllabus should be delivered during the first year of specialty training. This is expected to take about 40-45 hours of formal teaching in basic sciences related to imaging, during the early months of specialty training, supplemented by practical training and private study of material recommended by trainers. Basic knowledge of physics, cell biology and mathematics is assumed.
- 1.3 Assessment is in the form of a written multiple choice question (MCQ) paper, which is a component of the First FRCR Examination in Clinical Radiology. Further detail is available on the College's website.

### **2 AIMS OF THIS SYLLABUS**

- 2.1 Provide appropriate knowledge of the physical, cellular and molecular principles that underpin the following diagnostic medical imaging modalities: planar (projection) x-radiography, x-ray fluoroscopy, x-ray computed tomography (CT), ultrasound imaging, magnetic resonance imaging (MRI), optical imaging, planar (projection) radionuclide imaging, single photon emission computed tomography (SPECT), positron emission tomography (PET) and hybrid imaging techniques
- 2.2 Describe how the concepts of risk, safety and quality apply in these imaging modalities including the responsibilities of individuals and organisations.
- 2.3 Provide sufficient understanding of the principles underlying each imaging modality to enable selection of the most appropriate modality for a particular clinical situation, to select the optimal operating factors, to interpret the images produced, to communicate the results and to discuss the complete imaging process with professional colleagues.
- 2.4 Assist trainees to satisfy the requirements for adequate training in order to carry out professional roles in medical diagnostic imaging as specified by UK legislation and guidance and evolving best practice

### 3 **LEARNING OBJECTIVES**

Those who have followed this section of the syllabus should be able to:

- 3.1 Describe the structure and properties of matter, the phenomena of radioactivity and magnetism, the nature of ionising radiation, radiofrequency radiation, optical imaging and ultrasound and how they interact with matter and the differences between ionising and non-ionising radiation.
- 3.2 Distinguish and compare between different types of diagnostic medical image and understand how such images are created, reconstructed, processed, transmitted, stored and displayed.
- 3.3 Describe the construction and function of medical imaging equipment including the radiation, optical or ultrasound source, image-forming components and image or signal receptor and detectors used for QA and monitoring.
- 3.4 Indicate how imaging equipment is operated and describe the imaging techniques that are performed with such equipment.
- 3.5 Identify and compare the type of information contained in images from different modalities.
- 3.6 Distinguish between different indices of image quality, explain how they are inter-related and indicate how they are affected by changing the operating factors of imaging equipment.
- 3.7 Identify agents that are used to enhance image contrast and explain their action.
- 3.8 Explain how the performance of imaging equipment is measured and expressed.
- 3.9 Describe the principles of quality assurance and outline how quality control tests of imaging equipment are performed and interpreted.
- 3.10 Recognise artefacts in medical images and identify how they are removed or their impact is reduced.
- 3.11 Recognise the hazards and risks to patients, members of staff and members of the public associated with medical imaging and describe how their impact is reduced without compromising diagnostic image quality.
- 3.12 Identify the major pieces of UK legislation and guidance that affect the practice of medical imaging and interpret their requirements.
- 3.13 Describe the biological processes in disease that can be probed with functional and molecular imaging
- 3.14 Understand the concepts relevant to improving patient related outcomes

## 4 **SYLLABUS CONTENT**

The syllabus is intended as a guide and general indication to the breadth of the topics that may appear in the examination questions. It is not a teaching plan and the bullet points do not relate to equal amounts of study time. The syllabus should be studied to a depth sufficient to allow the learning objectives in Section 3 above to be achieved.

### 4.1 **Principles of medical diagnostic imaging**

- Projection (planar) and tomographic images
- Analogue and digital images
- Structure of digital images
- Digital image processing, fusion, transmission and storage
- Display and viewing of analogue and digital images
- Picture Archiving and Communications Systems (PACS)
- Quality assurance
- Concept of hybrid imaging

### 4.2 **Common themes for all imaging modalities**

- Image formation
- Image quality - contrast, noise, contrast resolution and spatial resolution
- Contrast agents
- Image processing and analysis
- Equipment performance measurement, test objects and quality control
- Image artefacts
- Hazards, risks and safety

### 4.3 **Matter and radiation**

- Structure of matter, the atom and the nucleus
- Nature and properties of charged particle and electromagnetic radiation
- Interaction of electrons with matter
- Production of x-rays
- Interaction of high energy photons with matter
- Filtration of x-ray beams
- Electron energy in solids
- Luminescence

### 4.4 **Ionising radiation dose**

- Absorbed dose and kinetic energy released to matter
- Effects of ionising radiation on living tissue
- Equivalent dose and effective dose
- Radiation risk
- Population dose from natural and artificial sources

### 4.5 **Radiography with x-rays**

- Construction, function and operation of computed and digital radiographic systems
- X-ray tube and x-ray beam
- Image receptors for computed and digital radiography
- Scatter rejection
- Contrast media – iodine, barium and air
- Dual energy radiography

- Film-screen radiography
- Mammography
- Radiographic tomography and tomosynthesis

#### 4.6 **Fluoroscopy with x-rays**

- Construction, function and operation of a fluoroscopy system
- Image receptor – image intensifier and flat panel detector
- Scatter rejection
- Automatic brightness control
- Image digitisation
- Angiography with contrast media, including digital subtraction techniques

#### 4.7 **Safety in radiography and fluoroscopy with x-rays**

- Radiation detectors and dose meters
- Measurement of absorbed dose and dose rate in air
- Estimation of patient absorbed dose
- Typical dose-area products, entrance surface doses and effective doses in radiography and fluoroscopy
- Detector dose indicators
- Factors affecting radiation dose
- Time, distance and shielding for dose reduction
- Children and pregnant patients
- Estimation and control of radiation dose to staff and members of the public
- Operational dose quantities
- Personal dosimetry
- Pregnant staff

#### 4.8 **Radioactivity**

- Nuclear stability
- Mechanisms of radioactive transformation
- Nuclear energy states and gamma emission
- Activity and radioactive decay
- Natural radioactivity
- Artificial radionuclides and their production
- Radiopharmaceuticals and their production

#### 4.9 **Planar radionuclide imaging**

- Construction, function and operation of a digital gamma camera
- Imaging collimators
- Image receptor – scintillation detector
- Scatter rejection
- Mechanisms and quantification of radiopharmaceutical localisation
- Static, whole-body, dynamic and gated imaging

#### 4.10 **Safety in planar radionuclide imaging**

- Activity measurement with radionuclide calibrator
- Estimation of patient absorbed dose
- Typical activities and effective doses
- Factors affecting radiation dose
- Time, distance and shielding for dose reduction
- Children and conception, pregnancy and breast-feeding in patients

- Estimation and control of radiation dose to staff and members of the public
- Pregnant staff
- Contamination and environmental dose rate monitoring
- Storage, handling and transportation of radioactive substances
- Storage and disposal of radioactive waste

#### 4.11 **UK framework for ionising radiation protection**

- Hierarchy of recommendations, legislation and guidance
- Justification, optimisation and dose limitation
- Ionising Radiations Regulations 1999 and Approved Code of Practice
- Risk assessment, restriction of exposure and dose monitoring
- Radiation Protection Adviser and Radiation Protection Supervisor
- Local Rules and work procedures
- Designation of working areas and classification of workers
- Dose limits and dose constraints
- Comforters and carers
- Ionising Radiation (Medical Exposure) Regulations 2000, Notes on Good Practice and 2006 amendment
- Duty holders and their training and responsibilities
- Employer's procedures
- Diagnostic reference levels
- Exposures for research, health screening and medico-legal purposes
- Medicines (Administration of Radioactive Substances) Regulations 1978 and 1995 and 2006 amendments
- Administration of Radioactive Substances Advisory Committee and Notes for Guidance
- Radioactive Substances Act 1993
- Registration to hold radioactive substances
- Authorisation to store and dispose of radioactive waste
- Medical and Dental Guidance Notes
- Notification and reporting of radiation incidents

#### 4.12 **Tomographic reconstruction**

- Angular and linear sampling of projection data
- Filtered back-projection and reconstruction filters
- Iterative reconstruction

#### 4.13 **X-ray computed tomography**

- Construction, function and operation of a CT scanner
- Helical and multi-slice scanners
- Image reconstruction
- CT angiography, CT fluoroscopy and gated imaging
- CT perfusion and physiological principles underpinning functional assessment
- Radiation dose to patients, staff and the public
- Radiation safety and factors affecting radiation dose

#### 4.14 **Single photon emission computed tomography**

- Construction, function and operation of a rotating multi-head gamma camera
- Image reconstruction
- SPECT/CT

- Radiation safety and factors affecting radiation dose
- Typical activities and effective doses to patients, staff and the public

#### 4.15 **Positron emission tomography**

- Construction, function and operation of a multi-detector ring system
- 2D and 3D acquisition
- Image reconstruction
- Standardised uptake value (SUV)
- PET/CT
- Radiation safety and factors affecting radiation dose
- Typical activities and effective doses to patients, staff and the public
- Understanding of metabolic pathways underpinning Fluorine-18 FDG use (the Warburg effect)

#### 4.16 **Nuclear magnetic resonance**

- Nuclear spin angular momentum and nuclear magnetic moment
- Bulk magnetisation and the effect of magnetic field strength
- Precession in a magnetic field and the Larmor equation
- Resonance with radiofrequency pulses
- Relaxation mechanisms and relaxation times
- Free induction decay signal

#### 4.17 **Magnetic resonance imaging**

- Construction, function and operation of a superconducting MRI scanner
- Permanent and resistive magnets
- Radiofrequency receiver coils
- Spin-echo pulse sequence
- Spatial localisation of the signal
- K-space, image acquisition and image reconstruction
- Multi-echo, fast spin-echo and single shot techniques
- Gradient echo imaging – basic spoiled and non-spoiled techniques
- Tissue suppression methods – short TI inversion recovery (STIR), fluid attenuated inversion recovery (FLAIR) and fat saturation
- Standard gadolinium extracellular space contrast agents
- Other MR contrast agents
- Magnetic resonance angiography (MRA)
- Basic principles of diffusion techniques and diffusion weighted imaging
- Dynamic contrast enhancement and perfusion imaging
- Principles of magnetic resonance spectroscopy (MRS)
- Spatial misregistration, chemical shift, susceptibility, motion, flow and other artefacts
- Cell biology principles underpinning dynamic contrast enhanced and diffusion weighted MRI

#### 4.18 **Safety in magnetic resonance imaging**

- Static magnetic field – projectiles, induced voltage, implants
- Fringe field and controlled area
- Time-varying gradient fields – eddy currents, stimulation, implanted devices, acoustic noise
- Radiofrequency fields – specific absorption rate, heating
- Safety of patients, staff and members of the public
- Pregnant patients
- Shielding and imaging room design

- Safety Guidelines for Magnetic Resonance Imaging Equipment in Clinical Use

#### 4.19 **Physics of ultrasound**

- Nature and properties of ultrasound
- Propagation and interaction of ultrasound in matter
- Scattering of ultrasound waves
- Piezoelectric effect
- Design and construction of ultrasound transducers
- Continuous and pulsed wave ultrasound
- Beam shape from a single transducer and an annular array
- The Doppler effect

#### 4.20 **Ultrasound imaging**

- A-mode and B-mode imaging
- Time-gain compensation
- Construction, function and operation of a real-time B-mode scanner
- Image acquisition and reconstruction
- M-mode
- Microbubble and particle suspension contrast agents
- Harmonic imaging
- Measurement of flow with continuous and pulsed Doppler ultrasound
- Duplex scanners
- Colour-flow and power Doppler imaging

#### 4.21 **Safety in ultrasound imaging**

- Physical effects - heating, streaming, cavitation and mechanical damage
- Intensity and energy limits
- Thermal and mechanical indices
- Measurement of power output
- Safety of patients, staff and members of the public
- Safety guidance

#### 4.22 **Optical Imaging**

- Basic Fluorescent imaging
- Basic Bioluminescent imaging
- Difference between optical imaging techniques
- Penetration depths
- Clinical applications

#### 4.23 **Functional and molecular imaging (FMI)**

- Meaning and principles of functional imaging and molecular imaging
- Biological and physiological processes – flow, perfusion, diffusion, uptake, excretion etc
- Comparison of imaging modalities for FMI – sensitivity, spatial resolution etc
- Use of extracellular, cell surface and intracellular targets

4.24 **The principles of biological processes that can be probed with functional and molecular imaging**

- Inflammation and immune response
- Tumour formation and proliferation
- Extracellular environment alteration
- Metabolism
- Infection
- Vascular remodelling and angiogenesis
- Hypoxia
- Thrombosis
- Cell stress and death
- Degenerative processes
- Tissue repair

## **2.3 ANATOMY**

### **1 INTRODUCTION**

- 1.1 The purpose of this section of the syllabus is to provide those undertaking specialty training in clinical radiology with appropriate knowledge of the anatomy needed to perform and interpret radiological studies. When linked to other training in clinical radiology, this will lead to the safe and effective application of diagnostic imaging for the benefit of patients.
- 1.2 A knowledge of radiological anatomy is fundamental to the study of radiology. The standard and level of anatomical knowledge tested and expected reflect the time available for training. The assessment is of knowledge of radiological anatomy – not surgical anatomy, surface anatomy or cadaveric anatomy – but applied anatomy that is relevant to clinical radiology.
- 1.3 It is intended that this syllabus should be delivered during the first year of specialty training. Training schemes should run a specific radiological anatomy teaching, over a period of about six months, supplemented by private study. This should build on basic knowledge of anatomy from previous medical training.
- 1.4 Assessment is in the form of an electronic image viewing session, which is a component of the First FRCR Examination in Clinical Radiology. Further detail is available on the College's website.
- 1.5 The understanding of anatomy is central to the interpretation of diagnostic imaging. The depth and breadth of anatomy knowledge will increase over an individual's training. The importance and central nature of anatomy to radiology is reflected by its appearance and integration throughout the radiology specific syllabus.

### **2 AIMS OF THIS SYLLABUS**

- 2.1 Provide appropriate knowledge of the anatomy that underpins all radiological imaging including radiography, fluoroscopy, angiography, computed tomography (CT), ultrasound imaging and magnetic resonance imaging (MRI).
- 2.2 Provide sufficient understanding of the radiological anatomy that is visible on each imaging modality to perform and interpret studies including communicating the results and discussion with clinical colleagues.

### **3 LEARNING OBJECTIVES**

Those who have followed this syllabus should be able to:

- 3.1 Describe and recognise the bony and soft tissue anatomy visible on radiographs, including common normal variants. This will include children of all ages.

- 3.2 Describe and recognise the radiological anatomy visible on CT, including multiplanar and surface shaded reformats. This will include solid organs such as the heart and lungs in addition to bones, vessels and muscles.
  - 3.3 Describe and recognise the radiological anatomy visible on ultrasound imaging, including the normal pregnant uterus (including first trimester). This will include solid viscera such as the liver and spleen, bones, vessels, major ligaments and tendons. Endocavity ultrasound, such as transvaginal, transrectal and endoscopic ultrasound, will be excluded.
  - 3.4 Describe and recognise the radiological anatomy of MRI, including solid viscera such as the brain, thoracic and abdominal organs, bones, joints, muscles and vessels.
  - 3.5 Describe and recognise the radiological anatomy of fluoroscopic studies of the gastro-intestinal, biliary, genito-urinary and vascular systems.
- NB: Nuclear medicine, including positron emission tomography, is excluded from the anatomy curriculum.

#### 4 **SYLLABUS CONTENT**

This syllabus is intended as a guide and general indication to the breadth of the topics that may appear in the examination questions. It is not a teaching plan and the bullet points do not relate to equal amounts of study time. The syllabus should be read in conjunction with the learning objectives in Section 3 above.

##### 1 **Head & Neck**

###### 1.1 ***Brain***

- Ventricles and CSF spaces
- Arteries and venous sinuses
- Basal nuclei and major white matter tracts
- Cerebrum and cerebellum
- Cranial nerves
- Pituitary and juxtaseilar structures

###### 1.2 ***Skull***

- Calvaria and base of skull

###### 1.3 ***Face and neck***

- Arteries and veins
- Sinuses
- Orbit and contents
- Facial skeleton
- Tongue and oral cavity
- Lymph node groups
- Larynx and pharynx
- Thyroid and parathyroid
- Salivary glands

## 2 Thorax

### 2.1 *Cardiovascular*

- Mediastinum, pericardium and lymph node groups
- Cardiac chambers, valves, arteries and veins
- Great vessels and azygous/hemi-azygous system

### 2.2 *Bronchopulmonary*

- Trachea, lobar and segmental bronchi
- Pulmonary vasculature
- Pleura and fissures

### 2.3 *Chest wall and diaphragm*

### 2.4 *Breast and axilla*

## 3 Abdomen and Pelvis

### 3.1 *Bowel*

- Oesophagus and stomach
- Duodenum, small bowel and appendix
- Colon, rectum and anus

### 3.2 *Upper Abdominal Viscera*

- Liver segments and blood vessels
- Biliary tree and gall bladder
- Pancreas, adrenals and spleen

### 3.3 *Abdominal wall*

### 3.4 *Spaces and planes*

- Perirenal and pararenal spaces and fasciae
- Peritoneal reflections and spaces
- Mesentery and omentum

### 3.5 *Genitourinary tract*

- Kidneys and pelvicalyceal systems
- Ureters and bladder
- Prostate, seminal vesicles and urethra
- Testes and epididymides

### 3.6 *Gynaecology*

- Ovaries and fallopian tubes
- Uterus and cervix
- Vagina

### 3.7 *Vascular supply*

- Portal venous system
- Aorta and major branches
- IVC and tributaries
- Azygous system

### 3.8 *Lymph node groups*

## 4 Musculoskeletal system

### 4.1 *Spine*

- Vertebrae, sacrum and joints
- Paraspinal muscles and ligaments
- Spinal cord, cauda equina and nerve roots

### 4.2 *Upper Limb*

- Bones and joints, including shoulder
- Muscles and nerves
- Blood vessels

### 4.3 *Lower Limb*

- Bones and joints, including pelvis
- Muscles and nerves
- Blood vessels

## 2.4 GENERIC CONTENT

### A Behaviours in the Workplace

#### A.1 Professionalism

To practise radiology employing values, behaviours and relationships that underpin the trust the public has in doctors and in accordance with the current GMC Good Medical Practice guidance.

Knowledge	Assessment Methods	GMP
Outline the concepts of modern medical professionalism	6,7	1
Outline the relevance of professional bodies		1
Know when to seek support	6,7,8	1
Skills		
Practise with:	6,7,8,11	1,2,3
<ul style="list-style-type: none"> <li>• Integrity</li> <li>• Compassion</li> <li>• Altruism</li> <li>• Continuous improvement</li> <li>• Humility</li> <li>• Excellence</li> <li>• Respect for cultural and ethnic diversity</li> <li>• Regard for the principles of equity</li> <li>• Insight</li> </ul>		
Adopt a reflective approach to radiological practice	6,7,8	1,2,3
Demonstrate insight regarding competence and limitations	6,7,8	1,2,3,4
Behaviours		
Demonstrate patient-centred practice	6,7,8	1,2,3,4
Use healthcare resources prudently and equitably	6,7,8,9	1,2,3,4
Act with honesty and sensitivity in a non-confrontational and non-discriminatory manner	6,7,8	1,2,4
Recognise situations when it is appropriate to involve professional bodies	6,7,8	1,2,3,4
Show willingness to act as a mentor and educator	8,10	1,3
Participate in professional regulation	8,9	1,4
Demonstrate ability to cope with uncertainty	6,7,8	1,2,
Show willingness to accept and act positively on appropriate constructive criticism or feedback	6,7,8	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Demonstrate awareness of the importance of professionalism in radiological practice	Fully incorporate the principles of professionalism in radiological practice	

## A.2 Working with Colleagues

To demonstrate good working relationships with colleagues and other healthcare professionals.

To acquire and develop appropriate and effective inter-personal skills, being able to resolve conflicts and develop good working relationships within the team

To support team development, bringing together different professions, disciplines and agencies, to provide high quality health care

Knowledge	Assessment Methods	GMP
Clinical Teams: Understand how a team works. Understand the roles & responsibilities of team members within the department and MDT. Know the roles of other clinical specialties and their limitations	7,8,11	1,2,3
Communication with Colleagues: Describe the principles of good communication and conflict resolution techniques. Describe local procedures and policies for expressing valid concerns about performance of any colleague (Risk Management)	8,11	1,2,3,4
Complaints: Define local and independent complaints procedures	8	1,2,3
Skills		
Clinical Teams: Communicate effectively. Seek advice if unsure. Recognise when to delegate. Show leadership and supervise safely	6,7,8,11	1,3
Communication with Colleagues: Use appropriate language. Select appropriate communication methods. Reduce or eliminate tension in difficult situations	7,8,11	1,2,3
Complaints: Anticipate potential problems. Manage dissatisfied colleagues	7,8,11	1,2,3,4
Behaviours		
Clinical Teams: Show respect for others' opinions. Work conscientiously and co-operatively. Recognise own limitations. Supervise less experienced colleagues	7,8,11	1,2,3,4
Communication with Colleagues: Show willingness to participate in MDTs. Treat colleagues fairly. Show willingness to question colleagues' opinions in the interest of patient care	6,7,8,11	1,2,3,4
Complaints: Act promptly, with honesty and sensitivity. Accept responsibility when appropriate	8	1,2,4
Descriptors		
<b>Core</b>	<b>Completion of Speciality Training</b>	
Awareness that positive relationships with colleagues and team working are essential	Be able to articulate points of view and lead in issues of professional debate	
Maintain personal portfolio	Engage in and contribute to MDTs and open departmental discussions	
	Demonstrate personal development in communication skills	
	Mentor/support junior staff and allied healthcare professionals guiding them towards improved team-work and communication skills	
	Lead MDT discussions	

### A.3 Relations and Communications with Patients

To maintain good professional relationships with all patients. Conduct professional interactions with vulnerable adults, children and their carers according to legislation.

Knowledge	Assessment Methods	GMP
GMC - Guide to Good Medical Practice	7,8	1
Vulnerable Adults: Knowledge of the definition and assessment of competence in the vulnerable adult. Understand the relevant legislation.	7,8	1
Children: Child protection legislation	7,8	1
Skills		
Treat patients with dignity and as individuals. Recognise the boundaries of the doctor/patient relationship	7,8	1,2,3,4
Be able to assess the mental /physical capacity of the patient and be able to explain consent procedures to all patients and/or carers in a way that is clearly understood	7,8	1,2,3
Practise within the recognised legislative framework for children	7,8	1,2,3
Behaviours		
Approach and listen to patients with an open caring mind	7,8	1,2,3,4
Development of a caring nature and empathy	7,8	1,2,3,4
Recognise challenging professional relationships and seek support	7,8	1,2,3,4
Respect patients' and carers' views	7,8	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Understand the importance of good professional relationships with patients	Achieve good professional, sympathetic and independent relationships with patients	
Be aware of issues relating to doctor patient relationships involving vulnerable adults and children	Develop independent doctor patient relationships with vulnerable adults and children	
Achieve good professional relationships with patients		

#### A.4 Personal Qualities

To develop personal qualities and behaviours necessary to lead but also to follow, when necessary, in dealing with complex situations and conflicting attitudes.

Knowledge	Assessment Methods	GMP
Develop abilities to deal with inappropriate patient and family behaviour	6,7,8	1,2,4
Respect the rights of all patients including children, vulnerable adults and the elderly	6,7,8	1,2,4
Understand the need to eliminate all forms of discrimination against patients (age, gender, race, culture, disability, spirituality and sexuality)	6,7,8	1,2,4
Show awareness of the need to put patient need ahead of self-convenience	6,7,8	1,2,4
Define the concept of medical professionalism		1
Understand the relevance and interactions of professional bodies (Royal Colleges, GMC, BMA, medical defence organisations, specialist societies)		1
Skills		
Assume a leadership role where appropriate	6,7,8,11	1,2,3,4
Practise with : <ul style="list-style-type: none"> <li>• integrity</li> <li>• compassion</li> <li>• altruism</li> <li>• continuous improvement</li> <li>• excellence</li> <li>• respect of cultural and ethnic diversity</li> </ul>	6,7,8,11	1,2,3,4
Work in partnership with allied healthcare professionals	7,8,11	3
Recognise and respond appropriately to unprofessional behaviour in others	6,7,8,11	3,4
Behaviours		
Recognise personal beliefs and biases and how they impact on service delivery	6,7,8	1,3
Recognise the need to use all healthcare resources prudently and appropriately	6,7,8,9	1,2
Recognise the need to improve clinical leadership and management skills	6,7,8,11	1,2,3,4
Recognise the situations when it is appropriate to involve professional and regulatory bodies	6,7,8	1,2,3,4
Be willing to act as a mentor, educator and role model	6,7,8,10	1,2,3,4
Participate in professional regulation and development	8	1,2,4
Recognise the need for equal access to healthcare	6,7,8,9	1,3,4
Recognise the need for reliability and accessibility throughout the healthcare team	6,7,8,11	1,2,3,4

## Descriptors

### Core

Work well in the context of multi-professional teams

Listen well to others and be considerate to other points of view

### Completion of Specialty Training

Respond positively to criticism and work to improve

Involve patients in decision making

Demonstrate ability to deliver feedback to members of the clinical team

Be able to manage difficult patient interactions and negotiate successful outcomes for patients and team members

Create positive open professional environment that is supportive of patients and staff

## B Good clinical care

### B.1 History taking

To elicit a relevant focused history from patients with complex issues. To establish a problem list including differential diagnosis(es) and formulate an imaging strategy

Knowledge	Assessment Methods	GMP
Comprehends importance of different elements of history	6,7	1
Knows likely causes and risk factors for conditions relevant to mode of presentation	6,7	1
Recognise that the patient's wishes and beliefs and the history should inform examination, investigation and management	6,7	1
Skills		
Identifies and overcomes possible barriers to effective communication	7	1
Manages time and draws consultation to a close appropriately	7	1
Manages alternative and conflicting views from family, carers, friends and members of the multi-professional team and maintains focus	7	1,3
Assimilates history from the available information from patient and other sources including members of the multi-professional team.	7	1,3
Recognises and interprets appropriately the use of non verbal communication from patients and carers	7,8	1,3
Behaviours		
Shows respect and behaves in accordance with Good Medical Practice	7,8	3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Obtains, records and presents accurate clinical history relevant to the clinical presentation.	Is able accurately to summarise the details of patient notes.	
Elicits most important positive and negative indicators of diagnosis	Demonstrates an awareness that effective history taking needs to take due account of patients beliefs and understanding	
Includes an indication of patient's views	Demonstrates ability to rapidly obtain relevant history in context of severely ill patients and/or in an emergency situation	
Starts to screen out irrelevant information.	Demonstrates ability to keep interview focused on most important clinical issues.	
Is able to format notes in a logical way and writes legibly		
Write succinct notes and is able to summarise accurately complex cases		

## B.2 Written records

To recognise the fundamental importance of accurate and timely communications and the maintenance of confidentiality

Knowledge	Assessment Methods	GMP
Demonstrate appropriate content of reports	5,6,7	1
Understand the relevance of data protection pertaining to patient confidentiality	5,6,7,8	1
Skills		
Produce concise and accurate reports with clear conclusions and other written correspondence tailored to the referrer	5,6,7	1
Write appropriate entries into case notes	7	1
Write referral letters to allied specialists and clinic letters if appropriate	7	1
Behaviours		
Appreciate the importance of timely dictation, cost-effective use of medical secretaries and the use of electronic communication	3,4,5,6,7,8	1,2,3,4
Contacts clinical colleagues appropriately dependent upon clinical scenarios	3,4,5,6,7,8,11	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Recognise importance of clear, concise and timely written communications and reports	Communication of important results directly to the clinical teams	
Start to produce clear, concise and timely written communications and reports under supervision	Independent production of clear, concise and timely written communications and reports	
	Effective independent communicator	

### B.3 Overall Clinical Judgement

To recognise the fundamental importance of integration of clinical information together with radiological features

Knowledge	Assessment Methods	GMP
Possess sufficient clinical knowledge to enable integration of clinical data and radiological features	2,3,4,5,6,7,8	1
Skills		
Correct interpretation of radiological features in the context of available clinical information	2,3,4,5,6,7,8	1
Behaviours		
Recognise the quality and quantity of clinical information required for accurate diagnosis or treatment decisions.	3,4,5,6,7,8	1,2,3,4
To add value to patient management	3,4,5,6,7,8,11	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of the importance of clinical knowledge in the interpretation of imaging and the need to identify any deficiencies in knowledge	Achieves sound clinical knowledge relevant to special interest areas of imaging	

## B.4 Time management and decision-making

To become increasingly able to prioritise and organise radiological and administrative duties in order to optimise patient care and use of resources.

Knowledge	Assessment Methods	GMP
Understand that some tasks may have to wait or be delegated to others	6,7,8	1,3
Understand the importance of prompt investigation, diagnosis and treatment in disease management	6,7	1
Skills		
Identify radiological and administrative tasks requiring urgent attention	6,7,8	1
Organise and manage radiological and administrative workload effectively, including lists and clinics where appropriate	6,7,8	1
Estimate the time likely to be required for essential tasks and plan accordingly	6,7,8	1
Delegate tasks and work to others appropriately and safely, when necessary	6,7,8	1,2,3
Behaviours		
Ability to work flexibly and deal with tasks in an effective fashion	6,7,8	1,2
Recognise when you or others are falling behind and take steps to rectify the situation	6,7,8	1,2,3
Communicate changes in priority to others	7,8,11	1,2,3
Remain calm in stressful or high pressure situations and adopt a timely, rational approach	7,8	1,2,3
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Recognises the need to identify work and compiles a list of tasks.	Recognises the most important tasks and responds appropriately	
Works systematically through tasks, recognising which are most urgent	Anticipates when priorities should be changed	
Utilises other radiological team members	Leading and directing the radiological team in an effective manner	
Requires some direction to ensure that all tasks managed efficiently	Supports others who are falling behind	
	Communicates and delegates rapidly and clearly	
	Calm leadership in stressful situations	

## B.5 Therapeutics and Safe Prescribing

To prescribe, review and monitor appropriate therapeutic interventions relevant to clinical practice including non – medication based therapeutic and preventative indications.

Knowledge	Assessment Methods	GMP
Indications, contraindications, side effects, drug interactions and dosage of commonly used drugs in radiology	2,4,5,7	1
Recall drugs requiring therapeutic drug monitoring and interpret results	2,4,5,7	1,4
Understand the indications for and drugs used for DVT prophylaxis	6,7	1,4
Understand patient safety and prescribing, including electronic clinical record systems and other IT systems	2,4,5,7	1,4
Understand the roles of regulatory agencies involved in drug use, monitoring and licensing (eg National Institute for Clinical Excellence (NICE), Committee on Safety of Medicines (CSM), and Healthcare Products Regulatory Agency and hospital formulary committees	2,4,5,7	1,4
Skills		
Review the continuing need for, effects and adverse effects of, long term medications relevant to the trainee's clinical practice	7	1
Anticipate and avoid defined drug interactions	7	1,2,3
Prescribe appropriate DVT prophylaxis	7	1,2
Advise patients (and carers) about important interactions and adverse drug effects relevant to radiology	7,8	1,2,4
Prescribe appropriately in pregnancy, and during breast feeding	7	1,2
Make appropriate dose adjustments following therapeutic drug monitoring, or physiological change (eg deteriorating renal function)	7	1,2
Recognise the importance of resources when prescribing, including the role of a Drug Formulary and electronic prescribing systems	7	1,2
Behaviours		
Remain open to advice from other health professionals on medication issues	6,7,8	1,2,3,4
Ensure prescribing information is shared promptly and accurately between a patient's health providers, including between primary and secondary care	6,7,8	1,2,3,4
Participate in adverse drug event reporting mechanisms	6,7,8	1,2,3,4
Remain up to date with therapeutic alerts, and respond appropriately	6,7	1,2

## Descriptors

### Core

Understands the importance of patient compliance with prescribed medication

Outlines the adverse effects of commonly prescribed medicines

Uses reference works to ensure accurate, precise prescribing

Takes advice on the most appropriate medicine in all but the most common situations

Makes sure an accurate record of prescribed medication is transmitted promptly to relevant others involved in an individual's care

Knows indications for commonly used drugs that require monitoring to avoid adverse effects

### Completion of Specialty Training

Knows how to report adverse effects and take part in this mechanism

Aware of the regulatory bodies relevant to prescribed medicines both locally and nationally

## B.6 The Safe Use of Sedation and Analgesia

To prescribe, administer and monitor the use of sedation and analgesia within clinical radiological practice.

Knowledge	Assessment Methods	GMP
Indications, contraindications, side effects, drug interactions, reversal and dosage of commonly used sedative and analgesic agents	2,4,5,7	1
Recall range of adverse drug reactions to commonly used sedative and analgesic agents	2,4,5,7	1
Recall drugs requiring therapeutic drug monitoring and interpret results	2,4,5,7	1,4
Be aware of other means of obtaining patient co-operation for radiological examinations without need for patient sedation or analgesia e.g. play therapy in paediatric radiology	7,8	1,2
Skills		
Access information to promote patient safety and prescribing, including electronic clinical record systems and prescribing references	2,4,5,6,7	1,4
Anticipate and avoid defined drug interactions, including appropriate use of reversal agents	6,7	1,2,3
Advise patients (and carers) about important interactions and adverse drug effects	6,7,8	1,2,4
Prescribe appropriately for safe sedation and analgesia including patient controlled analgesia	6,7	1,2
Make appropriate dose adjustments in relation to administration of sedatives or analgesics following physiological change (e.g. BMI, age, liver/renal function, respiratory/cardiac disease)	6,7	1,2
Understand the requirements for and principles of monitoring patients during and post sedation/analgesia administration	7	1,2
Obtain appropriate consent in relation to the use of sedation/analgesia	7	1,2,
Formal appropriate level of resuscitation training	certification	1,2
Behaviours		
Remain up to date with therapeutic alerts, and respond appropriately	6,7	1,2
Develop open team approach in relation to the delivery of sedation/analgesia services including close links with the anaesthetic department	7	1.2.3

## Descriptors

### Core

Understand the importance of patient compliance with prescribed medication

Use reference works to ensure accurate, precise prescribing

Take advice on the most appropriate sedation/analgesia in all but the most common situations

Make sure an accurate record of prescribed medication is transmitted promptly to relevant others involved in patient care

Know indications/adverse effects for commonly used sedative/analgesic drugs in radiology

### Completion of Specialty Training

Maximise patient compliance by utilising sedatives/analgesics in an individually tailored fashion that is compatible with optimal patient care

Maximise patient compliance by providing full explanations of the need for sedation/analgesia

Know how to report adverse effects and take part in this mechanism

Be aware of the regulatory bodies relevant to prescription of sedation/analgesia both locally and nationally

## B.7 Breaking Bad News

To recognise the fundamental importance of breaking bad news. To develop strategies for skilled delivery of bad news according to the needs of individual patients and their relatives / carers in the appropriate radiological context, e.g. breast imaging

Knowledge	Assessment Methods	GMP
Understand that how bad news is delivered irretrievably affects the subsequent relationship with the patient	7,8	1
Understand that sensitive communication of bad news is an essential part of professional practice	7,8	1,4
Understand that "bad news" has different connotations depending on the context, individual, social and cultural circumstances.	7,8	1,4
Understand that "bad news" may be expected or unexpected	7,8	1,4
Understand that every patient may desire different levels of explanation and have different responses to bad news	7,8	1,4
Understand that bad news is confidential but the patient may wish to be accompanied	7,8	1,4
Understand that breaking bad news can be extremely stressful for the doctor or professional involved	7,8	1,3,4
Understand that the interview may be an educational opportunity	7,8	1
Understand that it is important to:	7,8	1
Prepare for breaking bad news		
Set aside sufficient uninterrupted time		
Choose an appropriate private environment		
Have sufficient information regarding prognosis and treatment		
Structure the interview		
Be honest, factual, realistic and empathic		
Be aware of relevant guidance documents		
Skills		
Structure the interview e.g.:	8	1
Set the scene		
Establish understanding		
Discuss diagnosis, implications, treatment, prognosis and subsequent care		
Demonstrate to others good practice in breaking bad news	8	1,3,4
Involve patients and carers in decisions regarding their future management	8	1,2,3,4
Encourage questioning and ensure comprehension	8	1,2,3,4
Respond to verbal and visual cues from patients and relatives	8	1,2,3,4
Act with empathy, honesty and sensitivity avoiding undue optimism or pessimism	8	1,2,3,4
Behaviours		
Take appropriate role in breaking bad news	8	1,2,4
Respect the different ways people react to bad news	8	1,2,4

**Descriptors**

<b>Core</b>	<b>Completion of Specialty Training</b>
Recognises when bad news must be imparted	Able to break bad news in planned and unexpected settings in the appropriate radiological context
Recognises the need to develop specific skills	Skilfully delivers bad news in any circumstances including adverse events
Requires guidance to deal with most cases	Arranges follow up as appropriate

## C Managing Long-term Conditions

To pursue a holistic and long term approach to the planning and implementation of patient care, in particular to identify and facilitate the patient's role in their own care

Knowledge	Assessment Methods	GMP
Understand the natural history of diseases and illnesses that run a chronic course	2,6	1
Understand the role of rehabilitation services and the multi-disciplinary team to facilitate long-term care	2,6	1
Understand the concept of quality of life and how this can be measured whilst understanding the limitations of such measures for individual patients	2,6	1
Provide relevant evidenced based information to clinicians and where appropriate effective patient education, with support of the multi-disciplinary team	6,7,10	1,4
Skills		
Provide relevant evidenced based information with support of the multi-disciplinary team	7,8	1,3,4
Provide the relevant and evidence based information to the multidisciplinary team and to the patient in an appropriate medium to enable sufficient choice, when possible	7,9,11	1,3
Behaviours		
Show willingness and support for patient in his/her own advocacy, within the constraints of available resources and taking into account the best interests of the wider community	8,9	3,4
Show willingness to maintain a close working relationship with other members of the multi-disciplinary team, primary and community care	7,8,11	3
Descriptors		
Core	Completion of Specialty Training	
Describes relevant long term conditions	Demonstrates awareness of management of long term conditions relevant to the trainees practice	
Understands that "quality of life" is an important goal of care and that this may have different meanings for each patient	Provides the patient with evidence based information and assists the patient in understanding this material and utilises the team to promote excellent patient care	
Is aware of the need for promotion of patient self care and independence	Develops management plans in partnership with the patient and clinical teams that are pertinent to the patients long term condition	
	Contributes to the multidisciplinary team that is responsible for management of patients with long term conditions	
	Helps the patient networks develop and strengthen	

## D Infection control

To manage and control infection in patients attending a clinical radiology department. This includes controlling the risk of cross-infection, appropriately managing infection in individual patients, and working appropriately within the wider community to manage the risk posed by communicable diseases.

Knowledge	Assessment Methods	GMP
Know the importance of hand hygiene, equipment cleaning and Aseptic Non-Touch Technique in reducing Health Care Associated Infection (HCAI)	1,7	1
Know when to use personal protective equipment (PPE)	1,7	1
Know when to use and the principles of an Aseptic Non-Touch Technique (ANTT)	1,7	1
Know the action required in a needle stick injury	1,7	1
Know the responsibilities of the individual and employer in reducing HCAI	1,7	1
Relevant Literature: Trust Infection Control Policy / epic2 / DoH saving lives document / NPSA guidelines	2,7	1
Skills		
Good practice in hand washing and equipment cleaning	7,9	1
Appropriate use of PPE	7,9	1
Aseptic Non-Touch Technique	7,9	1
Safe disposal of sharps	7,9	1
Behaviours		
To adhere to Trust infection control policies	8,9	1,2,3,4
To attend mandatory training	ePortfolio review	1,2,4
To partake in and learn from relevant audit	9	1,2
Encourage all staff, patients and relatives to observe infection control principles	8	1,2,3
Recognise the risk of personal ill-health as a risk to patients and colleagues in addition to its effect on performance and behaves responsibly and appropriately	8	1,2,3,4

## Descriptors

### Core

Always follows local infection control protocols, including washing hands before and after seeing all patients.

Is able to explain infection control protocols to students and to patients and their relatives

Understands the links between antibiotic prescription and the development of noscomial infections

Discusses antibiotic use with a more senior colleague

### Completion of Specialty Training

Demonstrate an ability to perform complex clinical procedures whilst maintaining aseptic technique throughout, including those procedures which require multiple staff in order to perform the procedure satisfactorily

Identify potential for infection amongst high risk patients obtaining appropriate investigations

Communicate effectively to patients and their relatives with regard to the infection, the need for treatment and any associated risks of therapy.

Work in collaboration with external agencies in relation to reporting common notifiable diseases, and collaborating over any appropriate investigation or management

Identify the possibility of unusual and uncommon infections and the potential for atypical presentation of more frequent infections

Work in collaboration with diagnostic departments to investigate and manage the most complex types of infection including those potentially requiring isolation facilities

Work in collaboration with external agencies to manage the potential for infection control within the wider community including communicating effectively with the general public and liaising with regional and national bodies where appropriate

## E Clinical Governance, Risk Management, Audit and Quality Improvement

To be fully aware of risk management issues as applicable to the practice of radiology To fully incorporate the principles of clinical governance into day to day clinical practice To recognise the desirability of monitoring performance, learning from mistakes and openness in order to ensure high standards of care and to optimise patient safety		
Knowledge	Assessment Methods	GMP
Possess knowledge of risk management issues pertinent to an imaging department	1,7,8	1
Know the complications, risks and side effects of imaging investigations and treatments including ionising radiation and other biohazards. Understand the mechanisms to reduce risk	1,2,6,7,8,9	1
Understand the elements of clinical governance	8	1
Recognise that governance safeguards high standards of care and facilitates the development of improved clinical services	8	1
Define local and national significant event reporting systems relevant to specialty	8	1
Recognise importance of evidence-based practice in relation to clinical effectiveness	2, 5	1
Understand the use of patient early warning systems to detect clinical deterioration where relevant to outcomes	6,7,8,9	1,2
Keep abreast of national patient safety initiatives including National Patient Safety Agency, NCEPOD reports, NICE guidelines etc	8, 9	1,2
Shows knowledge of: <ul style="list-style-type: none"> <li>• Quality Improvement</li> <li>• Medical and clinical audit</li> <li>• Research and development</li> <li>• Integrated care pathways</li> <li>• Evidence-based practice</li> <li>• Clinical effectiveness</li> <li>• Clinical risk systems</li> <li>• Medical error</li> <li>• Complaints procedures</li> <li>• Risk assessments</li> <li>• Knows the benefits that a patient might reasonably expect from clinical governance</li> </ul>	2,3,4,6,7,8,9,11	1
Skills		
Be an active participant in clinical governance, audit and quality improvement	8,9	1
Discuss relevant risks with patients and obtain informed consent	1,7,8	1,2,4
Be able to balance risks and benefits with patients	1,7,8	1,2,4
Adopt strategies to reduce risk e.g. evidence based practice, reference to previous examinations	6,7,8,9	1
Contribute to quality improvement processes e.g. <ul style="list-style-type: none"> <li>• Audit of personal and departmental performance</li> </ul>	8,9	1,2,3

<ul style="list-style-type: none"> <li>• Errors / discrepancy meetings</li> <li>• Critical incident reporting</li> <li>• Root cause analysis</li> <li>• Unit morbidity and mortality meetings</li> <li>• Local and national databases</li> </ul>		
Maintain a folder of information and evidence, drawn from individual medical/radiological practice	ePortfolio review	1
Reflect regularly on standards of medical practice in accordance with GMC guidance on licensing and revalidation	8	1
Reflect on serious untoward incidents (SUIs) and complaints	ePortfolio review	1,2
Be able to handle and deal with complaints in a focused and constructive manner	8,9	1
<b>Behaviours</b>		
Respect individual patient choice and make patient care your first concern	6,7,8	1,2,3,4
Respect patients' privacy, dignity and confidentiality	6,7,8	1,2,3,4
Be truthful and admit error; engage with an open no blame culture and be prepared to learn from mistakes, errors and complaints	6,7,8	1,2,3,4
Show willingness to participate in safety improvement strategies such as critical incident reporting	8,9	1,2,3,4
Respond positively to outcomes of audit and quality improvement	6,9	1,2,4
Co-operate with changes necessary to improve service quality and safety	8,9	1,2,3,4
Practice evidence-based medicine	5,6,7,8	1,2,3,4
Recognise the importance of teamwork and share best practice with others	6,7,8,11	1,2,3,4
<b>Descriptors</b>		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of risk management issues in relation to the practice of radiology	Full incorporation of risk management issues in relation to the practice of radiology	
Awareness that clinical governance provides the overarching framework to unite the range of quality improvement activities.	Demonstrates personal and service performance	
Maintains personal portfolio	Leads in review of patient safety issues	
Able to define key elements of clinical governance	Implements change to improve service	
Designs audit protocols and completes audit loop	Engages and guides others to embrace governance	
Engages in audit and quality improvement projects		

## F Leadership/Management development

### F.1 Leadership

To recognise the desirability of involvement in medical leadership and assume increasing leadership roles		
Knowledge	Assessment Methods	GMP
Describe the principles of effective leadership	6,7,8,11	1
Skills		
Assume a leadership role	6,7,8,11	1
Ability to:	6,7,8,11	1
<ul style="list-style-type: none"> <li>• Delegate</li> <li>• Manage time</li> <li>• Make decisions</li> <li>• Negotiate</li> <li>• Challenge</li> </ul>		
Behaviours		
Act professionally	6,7,8	1,2,3,4
Be willing to ask for help	6,7,8	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of importance of leadership in radiology practice	Incorporation of leadership skills and qualities into day to day radiological practice Independent practice with reference to leadership roles	

## F.2 NHS Structure

To understand the structure of the NHS and the management of local healthcare systems in order to be able to participate fully in managing healthcare provision

Knowledge	Assessment Methods	GMP
Understand the guidance given on management and doctors by the GMC	8	1
Understand the local structure of NHS systems in your locality recognising potential differences between the four countries of the UK	8	1
Understand the structure and function of the healthcare system as they apply to your speciality	6,7,8,11	1
Awareness and principles of: <ul style="list-style-type: none"> <li>• Clinical coding</li> <li>• European Working Time Regulations</li> <li>• National Service Frameworks</li> <li>• Health Regulatory Agencies (NICE)</li> <li>• NHS Structure and Finance</li> <li>• Consultant contract</li> <li>• Resource allocation</li> <li>• Role of Independent Sector Providers</li> </ul>	6,7,8,11	1
Describe the principles of Recruitment and Appointment procedures		1
Skills		
Participate in managerial meetings	8	1
Take an active role in promoting the best use of healthcare resources	6,7,8,11	1
Work with stakeholders to create a sustainable patient-centred service	8	1
Employ new technologies	6,7	1
Behaviours		
Recognise the importance of just allocation of healthcare resources	6,7,8,11	1,2,
Recognise the varying roles of doctors, patients and carers as active participants in healthcare systems	6,7,8,11	1,2,3
Respond appropriately to healthcare targets and take part in service development	6,7,8,11	1,2
Show willingness to improve managerial skills	8,11	1
Engage in management activities (rota/audit lead, trainee representative on departmental/directorate management committee, interview panels)	8	1

## Descriptors

Core	Completion of Specialty Training
Awareness of management roles in the NHS	Describe the relationship between commissioners, General Practice and secondary care providers
Describe the principles and application of effective management	Participates in team and clinical directorate meetings including discussions around service development
Describe the roles of primary and secondary care services	Discuss the most recent guidance from relevant health regulatory agencies in relation to speciality.
	Describe the funding and structure of health services and how they relate to regional or devolved administration structures.
	Participate in collaborative discussions with directorate and other stakeholders to ensure that all needs and views are considered in managing services.

### F.3 Media Awareness

To recognise the importance of media awareness and public communications in healthcare delivery		
Knowledge	Assessment Methods	GMP
Know the importance of media awareness and public communications training and where to obtain it		1
Skills		
Recognise situations when media awareness and public communication skills are of value.	8	1,3
Recognise when it may be appropriate to implement such training and/or seek further advice from the Trust	8	1,3
Be able to handle enquires from press and other media effectively		1,3,4
Behaviours		
Act professionally	6,7,8,11	1,2,3,4
Be willing to ask for help	6,7,8	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of importance of public communications and media interactions	Engages in communication opportunities that arise outside the medical community Development of independent media skills Confident with individual/collective media engagement	

## G Ethical and legal issues

### G.1 Medical ethics and confidentiality

To know, understand and apply appropriately the principles, guidance and laws regarding medical ethics and confidentiality

Knowledge	Assessment Methods	GMP
Demonstrate knowledge of the principles of medical ethics	6,8	1
Outline and follow the guidance given by the GMC on confidentiality. Define the provisions of the Data Protection Act and Freedom of Information Act	6,7,8	1
Define the role of the Caldicott Guardian within an institution and outline the process of attaining Caldicott approval for audit or research	6,7,8,9	1
Outline the procedures for seeking a patient's consent for disclosure of identifiable information	6,7	1,2
Outline situations where patient consent, while desirable, is not required for disclosure e.g. public interest	6,7,8	1,2,3,4
Recognise the problems posed by disclosure in the public interest, without patient's consent	6,7,8	1,2,3,4
Recognise the factors influencing ethical decision making: religion, moral beliefs, cultural practices	6,7,8	1
Outline the principles of the Mental Capacity Act	6,7	1,2,3,4
Skills		
Use and share information with the highest regard for confidentiality, and encourage such behaviour in other members of the team	6,7,8,11	1,2,3,4
Use and promote strategies to ensure confidentiality is maintained e.g. anonymisation	6,7,8,9,11	1,2,4
Counsel patients on the need for information distribution within members of the immediate healthcare team	7,8,9,11	1,2,3,4
Counsel patients, family, carers and advocates tactfully and effectively when making important decisions regarding treatment	7,8,11	1,2,3,4
Behaviours		
Encourage ethical reflection in others	6,7,8,11	1,2,3
Show willingness to seek advice of peers, legal bodies, and the GMC in the event of ethical dilemmas over disclosure and confidentiality	6,7,8,11	1,2,3,4
Respect patient's requests for information not to be shared, unless this puts the patient or others at risk of harm	7,8,11	1,2,3,4
Show willingness to share information about their care with patients, unless they have expressed a wish not to receive such information	7,8	1,2,3,4
Show willingness to seek the opinion of others when making important decisions regarding treatment	7,8,11	1,2,3

## Descriptors

### Core

Use and share information with the highest regard for confidentiality adhering to the Data Protection Act and Freedom of Information Act in addition to guidance given by GMC

Define the role of the Caldicott Guardian within an institution, and outline the process of attaining Caldicott approval for audit or research

Familiarity with the principles of the Mental Capacity Act

Participate in discussions concerning important decisions regarding treatment

### Completion of Specialty Training

Counsel patients on the need for information distribution within members of the immediate healthcare team and seek patients' consent for disclosure of identifiable information

Able to assume a full role in making and implementing important decisions regarding treatment

## G.2 Valid consent

To obtain valid consent from the patient		
Knowledge	Assessment Methods	GMP
Outline the guidance given by the GMC on consent, in particular <ul style="list-style-type: none"> <li>Understand the consent process may culminate in, but is not limited to, the completion of the consent form.</li> <li>Understand the particular importance of considering the patient's level of understanding and mental state (also that of the parents, relatives or carers when appropriate) and how this may impair their capacity for informed consent</li> </ul>	7,8	1
Skills		
Present all information to patient (and carers) in a format they understand allowing time for reflection on the decision to give consent	7, 8	1,3
Provide a balanced view of all care options	7,8	1,3,4
Behaviours		
Respect a patient's right of autonomy even in situations where their decision might put them at risk of harm	7,8	1
Avoid exceeding the authority given by a patient	7,8	1
Avoid withholding information relevant to proposed care or treatment in a competent adult	7,8	1,3,4
Show willingness to seek advance directives	7,8	1,3
Show willingness to obtain a second/senior opinion and legal advice in difficult situations of consent or capacity	7,8	1,3
Inform a patient and seek alternative care where personal, moral or religious belief prevents a usual professional action	7,8	1,3,4
Descriptors		
Core	Completion of Specialty Training	
Obtains consent for straightforward treatments	Able to explain complex treatments meaningfully in layman's terms Obtain consent in "grey-areas" where the best option for the patient is not clear Obtains consent in all situations even when there are problems of communication and capacity	

### G.3 Legal framework of medical practice

To know, understand and act appropriately within the legal framework for practice		
Knowledge	Assessment Methods	GMP
Awareness of the following legislative pathways and potential differences within the disparate nations of the UK:		
<ul style="list-style-type: none"> <li>Child protection and protection of vulnerable adults</li> <li>Mental health legislation: the powers to detain a patient and giving emergency treatment against patient's will under common law</li> <li>Death certification and role of coroner / procurator fiscal</li> <li>Advance directives and living wills</li> <li>Withdrawing and withholding treatment</li> <li>Decisions regarding resuscitation status of patients</li> <li>Surrogate decision making such as Power of Attorney</li> <li>Organ donation and retention and awareness of local procedures</li> <li>Communicable disease notification</li> <li>Data Protection and Freedom of Information Acts</li> </ul>		1,2,3
Outline sources of medico-legal information		1
Outline the process of discipline in the event of medical malpractice		1,2,3
Outline the procedure to be followed when abuse is suspected		1,2,4
Skills		
Ability to prepare a medico-legal statement for submission to the Coroner's Court, Fatal Accident Inquiry and other legal proceedings and develop skills to present such material in court		1
Incorporate legal principles into day to day practice	6,7	1
Practise and promote accurate documentation within clinical practice	6,7,8	1,2,3
Behaviours		
Show willingness to seek advice from the Healthcare Trust, legal bodies (including defence unions), and the GMC on medico-legal matters	8	1,2,3,4
Promote reflection on legal issues by members of the team	7,8	1,2,3
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of sources of advice relating to medico-legal matters and understanding of situations in which such advice should be sought	Awareness of the legislative pathways detailed under the knowledge section above Incorporate legal principles into day to day practice Ability to prepare a medico-legal statement for submission to the coroner's court, fatal accident inquiry and other legal proceedings Readily seek advice from healthcare trust, legal bodies and the GMC on medico-legal matters	

## G.4 Equality and Diversity

To respect and have good interactions with patients and colleagues from diverse backgrounds		
Knowledge	Assessment Methods	GMP
Describe the equality and diversity framework	8, EQ certification	1,3,4
Understand the importance of equality and cultural diversity. Follow an open-minded approach to equality and diversity in all aspects of radiological practice	8, EQ certification	1
Be sensitive to and show consideration for the ways in which patients' cultural and religious beliefs may affect their approach to radiological procedures. Respond respectfully to the cultural and religious needs of the patient	8, EQ certification	1
Understand that patients' religious and cultural beliefs may conflict with best radiological practice. Know where to find legal and ethical guidelines to assist in resolving difficulties	8, EQ certification	1
Be aware of the ways in which trainees' personal experiences, values and attitudes might affect their professional practice and know when to refer a case to another colleague	8, EQ certification	1
Ensure that an equal, non-discriminatory approach is adopted in interactions with both patients and colleagues	8, EQ certification	1
Recognise the interaction between mental health and physical health, and that there cannot be good health without good mental health.	8, EQ certification	1
Be aware of the role that individuals and services can play in combating inequality and discrimination and contribute appropriately to this work	8, EQ certification	1
Ensure that all decisions and actions are in the best interests of the patient	8, EQ certification	1
Skills		
Communicate with patients and colleagues from diverse backgrounds	7,8, EQ certification	1,2
Respect diversity and recognise the benefits it may bring, as well as associated stigma	8, EQ certification	1,2
Be aware of the possible influence of, and sensitively deal with issues concerning socio-economic status during interactions with patients	7,8, EQ certification	1,2
Be able to communicate effectively with patients from diverse backgrounds and with special communication needs	7,8, EQ certification	1,2
Behaviours		
Respect diversity within clinical practice	7,8, EQ certification	1,2,3,4
Recognise issues of health that are related to social class	7,8, EQ certification	1,2,3,4
Adopt assessments and interventions that are inclusive, respectful of diversity and patient-centred	7,8, EQ certification	1,2,3,4
Respect diversity of status and values in patients and colleagues	7,8, EQ certification	1,2,3,4
Accept uncertainty arising from differences in values	7,8, EQ certification	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Aware of need to practise in accordance with guidance on equality and diversity	Independent practice in accordance with guidance on equality and diversity	

## H Maintaining good medical practice

### H.1 Insight

To recognise the fundamental importance of integration of clinical information together with radiological features		
Knowledge	Assessment Methods	GMP
Be willing to consult, to admit mistakes and to learn from adverse events	5,6,7,8	1
Skills		
Use and share information with other members of the team to improve patient outcomes	5,6,7,8,11	1,2,3
Reflects on own practice	8	1,2,3,4
Able to negotiate and discuss personal and team limitations	8	1,2,3,4
Behaviours		
Be willing to consult and to admit mistakes	3,4,5,6,7,8,11	1,2,3,4
Show willingness to seek the opinion of others when making important decisions regarding patient investigation and treatment	3,4,5,6,7,8,11	1,2,3,4
Encourages a climate of openness and reflection	8	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of the importance of knowing ones' own limitations and how to manage these	Recognises limitations and displays the ability to address any deficiencies in clinical/ radiological knowledge or skills Sound appreciation of limitations of self and others Demonstrates well developed strategies to address personal or team member deficiencies	

## H.2 Lifelong learning

Recognise the need for continued learning as a fundamental component of medical practice		
Knowledge	Assessment Methods	GMP
Recognise the importance of continuing professional development		1
Skills		
Recognise and use learning opportunities to keep up to date		1
Maintain a professional portfolio and use this to stimulate professional development	ePortfolio review	1
Monitor own performance through audit and feedback	9	1
Behaviours		
Be self-motivated and eager to learn	6,7,8	1,2,3,4
Show willingness to learn from colleagues and to accept constructive feedback	6,7,8	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Aware of need for continuing professional development and monitoring of own performance	Assumption of responsibility for personal life –long continuing professional development and monitoring of own performance	

### H.3 Ethical Research

To Recognise the fundamental importance of research in medicine. To develop understand and apply the principles, guidance and laws regarding ethical research

Knowledge	Assessment Methods	GMP
Outline the GMC guidance on good practice in research	6	1
Outline the differences between audit and research	9	1
Describe how clinical guidelines are produced	6	1
Demonstrate a knowledge of research principles	6	1
Outline the principles of formulating a research question and designing a project	6	1
Comprehend principal qualitative, quantitative, bio-statistical and epidemiological research methods	6	1
Outline sources of research funding	6	1
Skills		
Develop critical appraisal skills and apply these when reading literature	6	1
Demonstrate the ability to write a scientific paper	6	1
Apply for appropriate ethical research approval	6	1,2
Demonstrate the use of literature databases	6	1
Demonstrate good verbal and written presentations skills	6	1
Understand the difference between population-based assessment and unit-based studies and be able to evaluate outcomes for epidemiological work	6	1
Behaviours		
Recognise the ethical responsibilities to conduct research with honesty and integrity, safeguarding the interests of the patient and obtaining ethical approval when appropriate	6	1,2,3,4
Follow guidelines on ethical conduct in research and consent for research	6	1,2,4
Show willingness to the promotion of involvement in research	6,8	1
Descriptors		
Core	Completion of Specialty Training	
Demonstrate critical appraisal skills in evaluating medical literature	Comprehend the principles of qualitative, quantitative, bio-statistical and epidemiological research methods	
Awareness of research principles	Demonstrate the ability to write a scientific paper	
Follow guidelines on ethical conduct in research and consent for research	Demonstrate the use of literature data-bases	
	Good verbal and written presentation skills	
	Outline sources of research funding	
	Able to evaluate outcomes from differing types of epidemiological work	
	Understands how clinical guidelines are produced and their role in ethical research	
	Leads in department based research	

#### H.4 Evidence Based Practice

To employ an evidence based approach in the practice of radiology		
Knowledge	Assessment Methods	GMP
Define the principles of evidence-based medicine	2,5,6,7,9,11	1
Appreciate the role of guidelines	2,5,6,7,9,11	1
Skills		
Be able to critically appraise evidence	2,5,6,7,9	1
Demonstrate the ability to utilise guidelines	2,5,6,7,9	1,3
Be able to contribute to the evolution of guidelines	6,7,9	1
Behaviours		
Respect individual patient choice	5,6,7,8,9	1,2,3,4
Be truthful and admit error	5,6,7,8,9	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of importance of evidence based approach to the practice of radiology	Full use of evidence based approach in the practice of radiology	

## H.5 Information Technology

To recognise the fundamental importance of the acquisition of information technology skills to radiological practice		
Knowledge	Assessment Methods	GMP
Understand modern communication, search strategies, data storage and security	2,3,4,6,7	1
Skills		
Demonstrate competent use of relevant computer technology	2,3,4,6,7	1
Behaviours		
Engage with information technology relevant to clinical practice	2,3,4,6,7	1,2,3,4
Descriptors		
<b>Core</b>	<b>Completion of Specialty Training</b>	
Awareness of IT requirements for the practice of radiology	Full acquisition of IT requirements for the practice of radiology	

## I Teaching and training

To recognise the fundamental importance of understanding the value of teaching and training in clinical practice. To develop strategies for delivering education and assessment in a wide variety of formal and informal settings

Knowledge	Assessment Methods	GMP
Acknowledgement of the multi-faceted nature of knowledge as it relates to medical practice.	10	1
Understand the importance of a positive & constructive approach to mentoring & educational supervision	10	1
Develop an understanding of a range of adult learning principles: Identify leaning styles		
Construct educational objectives	10	1
Use appropriate questioning techniques		
Vary teaching formats & stimuli		
Understand the structure and differences between appraisal and assessment	10	1
Skills		
Delivery of varying teaching formats and stimuli to suit subject and situation	10	1
Demonstrate effective presentation of information in a variety of ways: lecture, small group presentations, written hand-outs, power-point presentations	10	1
Provide effective feedback and help develop reflective practice	8,10	1
Promote patient education	8,10	1
Undertake and deliver workplace based assessment	6,7,8,9,10,11	1
Behaviours		
Demonstrate a positive approach to both giving and receiving mentoring and educational supervision	8,10	1,3
Promote and encourage a constructive knowledge-sharing environment	8,10	1,2,3,4
Balances the needs of service delivery with educational imperative	8,10	1,4
Show willingness to participate in giving formal tuition in radiological/medical education	10	1
Recognise the importance of personal development as a teacher in relation to aspects of good professional behaviour	8,10	1,4
Maintain honesty and objectivity during appraisal and assessment	8,10	1,2,4

## Descriptors

### Core

Demonstrate understanding and awareness of the different opportunities to deliver education in both clinical and non-clinical settings

Delivers small group teaching to medical students, nurses or colleagues

Able to seek and interpret simple feedback

### Completion of Specialty Training

Engages in teaching delivery to allied health professionals and clinical groups

Partakes and encourages WpBA and reflective practice

Leads teaching episodes

Develops and delivers new opportunities to enhance learning and teaching with clear objectives and outcomes

Able to act as a mentor/appraiser to medical student, nurse, radiographer or colleague

Formalisation of interest in teaching – PgCert, Diploma (Optional)

## **2.5 RADIOLOGY SPECIFIC CONTENT**

All aspects of the radiology specific syllabus are referenced to illustrative examples of presentations and diagnoses. These examples are a guide to help both the trainer and trainee ensure sufficient curriculum coverage is obtained.

In delivery of core training, the syllabus content is referenced to common presentations. These reflect the need for trainees to show competences across the breadth of the curriculum with particular emphasis on the most important/common topics within the curriculum.

During higher training, the syllabus is linked to a range of common and uncommon diagnoses. These lists are neither exhaustive nor complete as higher training is an integral part of lifelong learning with no upper limits. These lists are recommended topic areas from within which the trainee should produce evidence of assessments for the attainment of CCT in clinical radiology.

## Breast Radiology

### Core Breast Training

To acquire basic clinical, pathological and radiological understanding of breast disease with reference to common presentations (Table BP)

Knowledge	Assessment Methods	GMP
Understand anatomy and physiology of breast, changes with age and patterns of disease spread	1	1
Understand the physics of image production and how it affects image quality with respect to mammography, ultrasound & breast MRI	1	1
Understand the principles of differentiation between normal breast, benign and malignant disease	2,3,4	1
Understand clinical presentation, pathogenesis and basic principles of treatment of breast disease	2,5,6	1
Understand indications for and determine optimal imaging examination	6,7	1
Understand basic principles underlying population screening and assessment of screen detected abnormalities	2,6	1,2
Awareness of local/national guidelines	2,7	1
Skills		
Interpret mammograms to recognize normal anatomy and discriminate between benign and malignant imaging findings	3,4,5,6,	1
Perform breast ultrasound to: discriminate cystic v solid mass; recognise typical features of benign and malignant masses; identify and discriminate between normal and abnormal axillary lymph nodes.	3,4,5,6,7	1
<b>Intervention:</b> Perform image guided cyst aspiration, abscess drainage, fine needle aspiration and core biopsy under supervision	7	1
<b>Intervention:</b> Observe breast stereotactic biopsy, vacuum assisted biopsy (VAB), localisation under ultrasound and x ray guidance and axillary node biopsy	7	1
Observe breast MRI reporting	6	1
Behaviour		
Apply/adhere to local/national guidelines	6,7	1
Observe and reflect on MDT working	6,7,8,11	1,3
Communicate sensitively and appropriately with patients	6,7,8	1,2,3
Involve seniors appropriately	6,7,8	1,3

**Table BP – Breast Radiology Presentations**

**Common Presentations (Core)**

**Symptomatic Presentations**

- Breast lump vs. generalised lumpiness
- Nipple inversion
- Paget's disease of the nipple
- Breast pain or tenderness
- Breast inflammation
- Assessment of integrity of breast implants
- Gynaecomastia

Presentations recalled from screening

- Mass
- Microcalcification
- Architectural distortion

## Level 1 Breast Training

To acquire detailed clinical, pathological and radiological understanding of breast disease with reference to presentations (Table BP) and common diagnoses (Table BD)

Knowledge	Assessment Methods	GMP
Understand technical aspects of mammography, ultrasound and MRI related to breast imaging	6,7	1
Understand the principles of population screening including potential harms and benefits and equality of access	6,10	1,2
Understand principles underlying quality assurance of a screening programme	6,10	1,2
Understand principles of risk, common risk factors and their relation to screening	6,10	1
Understand principles of ranges of treatment of breast cancer and their impact/dependence on imaging	6	1
Understand role of prognostic factors in breast cancer treatment and follow-up	6	1
Understand principles of evaluation of tumour response to treatment and role of different modalities: mammography, ultrasound and MRI	6	1
Understanding of standards for MDTM	6,10,11	1,2
Knowledge of range of established imaging studies relevant to breast imaging and their role. Awareness of novel techniques	6	1
Knowledge of staging for breast malignancy including indications and appropriate techniques	6	1
Understand the principles of breaking bad news – see Good Clinical Care B7	7	1
Skills		
Report symptomatic mammograms	6,7	1
Recognise radiological features of mammographic abnormalities found in population screening & surveillance	6,7	1
Be involved in triple assessment clinics	7	1,3
Perform breast and axillary ultrasound in the assessment of symptomatic breast disease	6,7	1
Perform Interventions of breast and axilla under ultrasound and stereotaxis: FNA /core/vacuum biopsy/localisations/ drainages	7	1
Recognise atypical appearances of common conditions	6,7	1
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7	1
Recognise how diagnosis affects management pathway	6,7	1

<b>Behaviour</b>		
Tailor examination to clinical indication	7	1
Initiate additional examination as appropriate	7	1
Seek additional clinical information relevant to case	6,7	1,2
Formulate appropriate DDx	6,7	1
Regular attendance at MDT meetings	6,7,11	1
Work in close cooperation with wider MDTs	6,7,8,11	1
Be involved in communicating malignant results to patients in accordance with local practice	6,7,8	1
Timely communication of results	6,7,8	1,2,3
Undertake and practise teaching related to breast imaging	8,10	1,3

## Level 2 Breast Training

To acquire detailed clinical, pathological and radiological understanding of breast disease with reference to presentations (Table BP) and uncommon diagnoses (Table BD)

Knowledge	Assessment Methods	GMP
Detailed knowledge of breast anatomy and variants	6,10	1
Link presentation with likely diagnoses	6,7	1
National guidelines and current literature	6,7,9,10	1
Understand structure & management of National Breast Screening Programme	6,7	1
Understand principles of evidence-based practice with respect to screening, treatment and evaluation of novel treatment	6,7	1
Attended National Breast Screening Training Centre course	Certificate	1
Skills		
Undertake staging according to national/local guidelines	6	1
Report Breast MR	6,7	1
Observe MR guided breast biopsy	7	1
Take part in PERFORMS	Certificate & Feedback	1
Evaluate tumour response	7	1
Evaluate breast prosthesis integrity	6,7	1
Provide expert opinion on appropriate patient imaging	6,7	1
Provide expert image interpretation	6	1
Be able accurately to report broad case mix	6	1
Write clear succinct reports which emphasise the key findings and diagnoses	6,7,8	1
Read 5000 screening mammograms a year with audit of reading performance	9	1,2,4
Behaviour		
Highly organised work pattern	8	1
Automatically prioritise cases according to clinical need	6,7,8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Be able succinctly to relate clinical and imaging findings	6,7	1
Be able to communicate malignant results to patient and discuss likely treatment	6,7	1
Undertake an active role in service delivery	6,7,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,3
Offer timely specialist opinion	8	1,2
Discuss with specialist centre appropriately	7,8	1,2,3
Participate in regional professional QA meetings	8,9	1,2,3,4
Be involved in breast imaging audit & research	8,9	1,2,3,4

**Table BD – Breast Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Benign Disease, to include:**

- Fibroadenoma
- Lipoma
- Hamartoma
- Papilloma
- Cyst
- Radial Scar/Complex Sclerosing Lesion
- Benign Microcalcification
- Gynaecomastia

**Malignant Disease**

Tumour – in-situ, invasive, metastatic

**Indeterminate Disease**

- Atypical ductal hyperplasia
- Lobular neoplasia

**Outcomes from Breast Screening and Surveillance**

**Breast Cancer Staging and Prognosis**

Loco regional and TNM staging and use of prognostic indicators

## Cardiac Radiology

### Core Cardiac Radiology Training

To acquire basic clinical, pathological and radiological understanding of cardiac and cardiovascular disease with reference to common presentations (Table CP)

Knowledge	Assessment Methods	GMP
Recall relevant basic anatomy and physiology, in clinical practice	1,6	1
Understand clinical significance of pathology associated with presentation and link with likely primary and differential diagnoses	2,3,4,5,6,7	1
Determine optimal imaging examination	3,4,5,6	1
Local/regional guidelines in relation to presentations	3,4,5,6,8	1
Skills		
Construct appropriate imaging pathway considering different pathologies and management options and according to available resource and case complexity.	3,4,5,6	1,3
Plain x-ray interpretation and reporting with awareness of limitations	3,4,5,6	1
Basic cardiac CT and MR interpretation and reports for common presentations and incidental findings	3,4,5,6	1
Decision making	3,4,5,6,8	1
<b>Intervention</b> – No specific requirement		
Behaviour		
Apply/adhere to local/regional guidelines	5,6,7	1
Prioritise workload to respond to most urgent cases first	5,6,7,8	1,4
Rapid communication of results	5,6,7,8	1,2
Appropriate involvement of seniors	5,6,7,8	1,2,3
Communicate with patients and obtain informed consent where appropriate	6,7	1,2,3
Attend MDTs	8,11	1,2,3

**Table CP – Cardiac Radiology Presentations**

**Common Presentations (Core)**

- Chest pain – cardiovascular origin
- Chest trauma
- Exertional dyspnoea
- Stroke / Paradoxical embolism
- Cyanosis
- Sudden collapse
- Syncope
- Arrhythmia
- Coronary syndrome
- Stable angina
- Unstable angina
- MI
- Pleural effusion
- Heart failure syndrome
- Pericarditis
- Congenital heart disease
- Endocarditis

## Level 1 Cardiac Radiology Training

To acquire detailed clinical, pathological and radiological understanding of cardiac and cardiovascular disease with reference to presentations (Table CP) and common diagnoses (Table CD)

Knowledge	Assessment Methods	GMP
Recognise atypical presentations of common conditions	6, 10	1
Link presentation with likely diagnoses	6, 10	1
Essential cardiac anatomy	6, 10	1
Awareness of the range of Cardiac Studies	6, 10	1
Local/regional guidelines in relation to presentations	6,8	1
Familiarity with more specialised imaging techniques (CT coronary calcium scoring, CT coronary angiography, Basic Echocardiography, Cardiac MRI, Interpretation of Stress studies)	6,7,10	1
Skills		
Require minimal supervision with most cases	6	1
Recognise atypical appearances of common conditions	6	1
Recognise/seek constellations of appearances which advance diagnosis	6	1
Recognise how diagnosis affects management pathway	6	1
Undertake Basic Echocardiographic USS (Optional)	6,7	1
Cardiac CT including coronary calcium scoring, CT coronary angiography	6	1
Cardiac MRI	6	1
Cardiac Nuclear Medicine	6	1
Interpretation of Stress studies	6	1
<b>Intervention-</b> (Optional) Drainage of Pericardial Effusions	7	1
Behaviour		
Seek additional clinical information relevant to case	6,7,8	1
Initiate additional examination as appropriate	6,7,8	1,2,4
Formulate appropriate DDX	6,7	1,2,3
Appropriate involvement of seniors	6,7,8	1,2,3
Defer to senior colleagues/specialists	6,7,8	1,2,3,4
Participate in MDTs	8,11	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Cardiac Radiology Training

To acquire detailed clinical, pathological and radiological understanding of cardiac and cardiovascular disease with reference to uncommon presentations and diagnoses (Table CD)

Knowledge	Assessment Methods	GMP
Detailed understanding of cardiac and vascular anatomy and variants	6, 10	1
Recognition of uncommon conditions mimicking common diagnoses	6, 10	1
Understanding of anatomy of congenital cardiac disease	6, 10	1
Detailed understanding of National guidelines and current literature	6, 10	1
Understanding of complete range of cardiac imaging	6,7,10	1
Skills		
Specialist vascular stress studies e.g. exercise stress tests	6	1,3
Advanced cardiac ultrasound e.g. stress & non-stress echocardiography, IVUS (optional)	6,7	1
Specialist CT/MR e.g. complex congenital heart disease	6	1
PET-CT of cardiac disease including malignancy	6	1
Provide expert opinion and interpretation on appropriate patient imaging	6	1
Write clear succinct reports which emphasise the key findings and diagnoses	6,7	1
<b>Intervention-</b> (Optional) Coronary angioplasty & stenting, ablative therapies	7	1
Behaviour		
Active role in service delivery	6,7,8	1
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3

**Table CD – Cardiac Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Congenital Heart Disease (Adult onset)**

**Major Vessel Disease**

- Thoracic aneurysm
- Marfan's syndrome
- Vasculitis, e.g. Takayasu's disease

**Right Heart Disease**

- Pulmonary Embolism
- Relations to Lung Disease
- ARVC

**Cardiac/Thoracic Vascular Trauma**

- Blunt trauma
- Aortic Dissection, Transection/Rupture

**Complications of Medical/Surgical/IR Treatments**

- Amiodarone, Digoxin
- Cardiac catheterisation
- Stents/stent grafts
- Valve/aortic surgery
- Long term sequelae of surgery for congenital heart disease

**Coronary Artery Disease**

- Myocardial Ischaemia & Infarction
- Ventricular Aneurysm
- Coronary artery Aneurysm
- Coronary Calcium
- Coronary disease specific to the Elderly/Female

**Valve Disease**

- Stenotic and Incompetent Cardiac Valves
- Endocarditis
- Sub and supra-valvular disease

**Myocardial disease**

- Acute myocarditis
- Dilated/Obstructive and Restrictive Cardiomyopathies
- Related to Systemic Disease

**Pericardium**

- Acute Pericarditis
- Cardiac tamponade
- Tuberculous pericardial disease

### Diagnoses – Common/Uncommon (Level1/2)

- Restrictive pericardiac disease
- Malignant pericardial disease

#### **Cardiac Tumours**

- Intracardiac tumours- myxomas, haemangiomas & sarcomas
- Secondary tumours

#### **Arrhythmias**

- Disease/endocrine related
- Invasive treatments

#### **Hypertension**

- Hypertensive cardiac disease
- Systemic Disease related

## Emergency Radiology

### Core Emergency Training

To acquire basic clinical, pathological and radiological understanding of emergency disease with reference to common presentations and diagnoses (Table EP)

Knowledge	Assessment Methods	GMP
Understand clinical significance of pathology associated with emergency presentation and link with likely diagnoses	2,4,5,6	1
Applied anatomy to interpret emergency imaging	1,6	1
Understand the role of radiology in the acute setting	2,5,6	1
Local/regional guidelines in relation to presentations	2,6	1
Skills		
Determine optimal imaging examination	4,5,6	1
Plain x-ray interpretation and limitations	4,5,6	1
Perform and interpret contrast studies – swallows, single contrast enemas	6,7	1
Basic abdominal ultrasound	6,7	1
Basic CT/MRI interpretation and report presentations	6	1
<b>Intervention</b> – see General and non vascular intervention	7	1
Behaviour		
Applies / adheres to local/regional guidelines	2,7	1,2
Prioritise workload to respond to most urgent cases first	6,7	1,2
Rapid communication of results	6,7	1,3
Appropriate involvement of seniors	8	1,3

**Table EP – Emergency Radiology Presentations**

**Common Presentations (Core)**

**Neurology**

- Head / spinal injury
- Severe headache
- Reduced conscious level seizures stroke / ischaemic syndromes
- Acute spinal / cauda equina / nerve root syndromes

**Cardiac/ Chest**

- Chest pain
- Breathlessness
- Massive haemoptysis

**Vascular**

- Haemorrhage from any source.
- Aortic rupture, dissection, intramural haematoma.
- Deep vein thrombosis
- Vena caval obstruction
- Acute ischaemic syndromes

**Gastrointestinal**

- Acute abdomen
- Abdominal pain
- Diarrhoea
- Vomiting
- Gastrointestinal bleeding

**Genitourinary**

- Haematuria
- Loin pain
- Difficulty in micturition

**Musculoskeletal**

- Bone pain
- Joint pain
- Trauma

**Paediatric**

See sections above plus

- Non accidental injury

## Level 1 Emergency Training

To acquire detailed clinical, pathological and radiological understanding of emergency disease with reference to presentations (Table EP) and common diagnoses. (Table ED)

Knowledge	Assessment Methods	GMP
Recognises atypical presentations of common conditions	6,7,10	1
Skills		
Requires minimal supervision with most cases	6,7	1
Recognises atypical appearances of common conditions	6,7	1
Recognises / seeks constellations of appearances which advance diagnosis	6,7	1
Recognises clinical priority of certain presentations	6,7	1
Recognises how diagnosis affects management pathway	6,7	1
Behaviour		
Seeks additional clinical information relevant to case	6,7,8	1,2,3
Tailors examination to clinical indication	6,7	1
Initiates additional examination as appropriate	6	1
Formulates appropriate DDx	6	1
Take part in teaching and training	8,10	1

## Level 2 Emergency Training

To acquire detailed clinical, pathological and radiological understanding of emergency disease with reference to presentations (Table EP) and uncommon diagnoses. (Table ED)

Knowledge	Assessment Methods	GMP
Detailed understanding of acute clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant anatomy relevant to above	6,10	1
Recognition of uncommon conditions mimicking common diagnoses	6,10	1
Skills		
Provides expert opinion on appropriate patient emergent imaging	6,7	1
Provides expert image interpretation	6	1
Able accurately to report on complete range of emergency cases	6	1
Writes clear succinct reports which emphasise the key findings and diagnoses	6,8	1
Behaviour		
Highly organised work pattern	8	1,2
Automatically prioritises cases according to clinical need	6,8	1,2
Able to discuss complex cases with referring clinicians and colleagues	6,8	1,3
Quickly establishes the clinical problem	6,8	1
Able succinctly to relate clinical and imaging findings	6,8	1,2
Have an active role in service delivery	6,7,8	1
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3

**Table ED – Emergency Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Neurology**

- Ischaemic event, cerebrovascular accident
- Intracranial bleeding
- Dural sinus thrombosis
- Coning
- Intracranial / intraspinal infection
- Intracranial / intraspinal tumour
- Intracranial / intraspinal trauma
- Acute spinal cord, cauda equina, nerve root compression / injury

**Cardiac/ Chest**

- Major airway compromise
- Pulmonary embolism
- Pneumothorax
- Pneumonia
- Lung collapse
- Heart failure
- Cardiac tamponade

**Vascular**

- Acute aortic abnormality
- Acute vascular occlusion
- Venous thrombosis / obstruction
- Haemorrhage: all causes

**Gastrointestinal**

- Bowel Perforation
- Inflammation
- Obstruction
- Intra abdominal sepsis
- Pancreatitis
- Abdominal Visceral/ Mesenteric Injury

**Genitourinary**

- Renal tract obstruction
- Renal calculi
- Renal tract infection
- Renal tumour

**Musculoskeletal**

- Fractures and dislocations
- Bone and joint infection
- Non accidental injury

## Diagnoses – Common/Uncommon (Level1/2)

### Paediatric

- See sections above plus non accidental injury
- Bronchiolitis
- Intussusception
- Necrotising enterocolitis
- Malrotation
- Pyloric stenosis

### General

- See sections above

## Gastro-intestinal Radiology

### Core Gastro-intestinal Training

To acquire basic clinical, pathological and radiological understanding of gastrointestinal disease with reference to common presentations (Table GP)

Knowledge	Assessment Methods	GMP
Recall basic anatomy and physiology, in clinical practice relevant to imaging examinations of the: <ul style="list-style-type: none"> <li>Gastrointestinal tract</li> <li>Hepatobiliary tract</li> <li>Pancreas</li> </ul>	1,6	1
Imaging changes of anatomically relevant surgical techniques and their complications	2,4,5,6	1
Understand clinical significance of pathology associated with presentation and link with likely diagnoses	2,3,4,5,6,7	1
Understand indications, contraindications and limitations of relevant specialised barium/contrast imaging examinations of the: <ul style="list-style-type: none"> <li>Gastrointestinal tract</li> <li>Hepatobiliary tract</li> </ul>	3,4,5,6,7	1
Recall relevant indications and limitations of Ultrasound, CT and MR	3,4,5,6,7	1
Understand indications and contraindications of relevant interventional techniques	7	1
Skills		
Construct appropriate imaging pathway considering different pathologies and management options and according to available resource and case complexities	3,4,5,6	1
Report plain radiographs relevant to GI, hepatobiliary system and pancreas with awareness of limitations	3,4,5,6	1
Perform and report barium and water soluble contrast examinations	3,4,5,6,7	1
Performance/protocol of basic non invasive imaging; US, CT, MRI	7	1
Write provisional interpretation/report of imaging and inform clinicians and MDTs of findings urgently, where relevant, according to local guidelines	3,4,6,7,11	1
<b>Intervention</b> – Anatomically relevant image guided biopsy and drainage	7	1
Behaviour		
Apply/adhere to local/regional guidelines	5,6,7	1
Prioritise workload to respond to most urgent cases first	5,6,7,8	1,2
Rapid communication of results	5,6,7,8	1,2,3
Appropriate involvement of seniors	5,6,7,8	1,2,3
Attend MDTs	8,11	1,3

**Table GP – Gastro-intestinal Radiology Presentations**

**Common Presentations (Core)**

**Dysphagia**

**Dyspepsia, Abdominal / Pelvic Pain**

- Acute
- Chronic
- Acute on Chronic

**Change in Bowel Habit/ Intestinal Obstruction**

- Acute
- Chronic

**Anaemia / GI Bleeding**

- Haematemesis
- Melaena
- Rectal Bleeding

**Weight Loss / Steatorrhoea / Malabsorption**

**Jaundice / Abnormal Liver Function**

**Abdominal/Pelvic Mass**

**Trauma**

## Level 1 Gastro-intestinal Training

To acquire detailed clinical, pathological and radiological understanding of gastrointestinal disease with reference to presentations (Table GP) and common diagnoses (Table GD)

Knowledge	Assessment Methods	GMP
Recognise atypical presentations of common conditions	6,10	1
State indications and limitations of specialist liver imaging including US contrast and liver specific MR contrast agents	6,10	1
State indications and limitations of specialist GI studies including optical, ultrasonic and cross sectional	6,10	1
Skills		
Require minimal supervision with most cases	8	1
Perform and report specialised GI imaging techniques e.g. <ul style="list-style-type: none"> <li>• CT Colonography</li> <li>• US/CT/MR assessment of small bowel</li> <li>• Liver specific MR contrast</li> <li>• Contrast enhanced US</li> </ul>	6,7	1
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise how diagnosis affects management pathway	6,7	1
Intervention –		
<ul style="list-style-type: none"> <li>• Cholecystotomy</li> <li>• PTC</li> <li>• Gastrostomy</li> </ul>	7	1
Behaviour		
Seek additional clinical information relevant to case	6,7	1
Tailor examination to clinical indication	6,7	1
Initiate additional examination as appropriate	6,7	1
Formulate appropriate DDx	6,7	1
Participate in MDTs	8,11	1,3
Discuss cases with specialist centre appropriately	7,8	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Gastro-intestinal Training

To acquire detailed clinical, pathological and radiological understanding of gastrointestinal disease with reference to uncommon presentations and diagnoses (Table GD)

Knowledge	Assessment Methods	GMP
Detailed understanding of clinical presentations and diagnoses	6,7,10	1
Detailed knowledge of normal and variant anatomy relevant to above	6,7,10	1
Recognition of uncommon conditions mimicking common diagnoses	6,7,10	1
Familiarity with pathology causing pelvic floor and anorectal dysfunction	6,7,10	1
Familiarity with the indications, contraindications and limitations of optical endoscopic examinations of the GI tract and their use in biliary tract pathology, biopsy, drainage and stenting procedures	6,7,10	1
Familiarity with endoscopic ultrasound and its use for staging oesophageal, pancreatic and rectal tumours	6,7,10	1
Detailed understanding of national guidelines and current literature	6,7,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6,7	1
Provide expert image interpretation	6,7	1
Be able accurately to report most cases which emphasise the key findings and diagnoses	6,7	1
Organise and undertake appropriate imaging pathways in investigating conditions	6,7	1
Perform relevant imaging techniques for pelvic floor and anorectal functional assessment	6,7	1
Perform endoscopic ultrasound for assessment of oesophageal, pancreatic and rectal tumours	7	1
Optional - Perform optical endoscopy of the GI tract for diagnostic and therapeutic purposes, including biopsy and stenting of the GI and biliary tract	7	1
<b>Intervention –</b>		
<ul style="list-style-type: none"> <li>• Gastrointestinal and biliary stenting</li> <li>• Percutaneous ablation techniques,</li> <li>• Venous and enteral access for nutritional support</li> <li>• Transarterial embolization and chemoembolization techniques</li> <li>• TIPSS</li> </ul>	7	1
Behaviour		
Highly organised work pattern	8	1
Automatically prioritise cases according to clinical need	6,7,8	1
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Quickly establish clinical problem	6,7	1
Be able succinctly to relate clinical and imaging findings	6,7	1
Active role in specialised service delivery	8	1,3
Offer timely specialist opinion	8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,3

**Table GD – Gastro-intestinal Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Oropharynx**

- Congenital
- Benign and malignant strictures
- Extrinsic compression
- Pharyngeal pouch
- Functional

**Oesophagus**

- Congenital
- Gastro-oesophageal reflux disease
- Inflammatory
- Infectious
- Benign and malignant strictures
- Functional eg spasm, achalasia
- Vascular

**Stomach**

- Congenital
- Hiatus hernia
- Benign and Malignant Tumours
- Inflammatory eg peptic ulcers, gastritis, Crohn's
- Infectious
- Iatrogenic (Post-surgical)
- Gastroparesis

**Small Bowel**

- Congenital
- Inflammatory eg Crohn's
- Infectious
- Obstruction
- Paralytic Ileus
- Malabsorption eg Coeliac disease, Infiltrative disorders
- Benign and Malignant Tumours
- Vascular eg ischaemia
- Iatrogenic (Post-surgical)

## Diagnoses – Common/Uncommon (Level1/2)

### Large Bowel

- Congenital
- Polyps
- Tumours
- Inflammatory eg Diverticulitis, Inflammatory Bowel disease
- Infection
- Vascular eg ischaemia
- Obstruction eg tumour, volvulus
- Trauma
- Functional disorders

### Gallbladder and Biliary Tract

- Gallstones
- Inflammatory
- Infection
- Tumours
- Benign biliary strictures
- Autoimmune

### Pancreas

- Congenital
- Acute and chronic pancreatitis
- Tumours
- Cystic Fibrosis

### Liver

- Tumour
- Infection eg Hepatitis, parasitic
- Fatty infiltration
- Cirrhosis
- Vascular
- Myeloproliferative disorders
- Storage disorders
- Autoimmune
- Congenital

### Spleen

- Vascular eg portal hypertension, infarcts
- Cysts
- Benign and Malignant Tumours
- Infection
- Inflammatory
- Trauma

## Diagnoses – Common/Uncommon (Level1/2)

### Peritoneal Cavity

- Congenital
- Cysts and Pseudocysts
- Benign and Malignant Tumours
- Inflammatory
- Infection
- Haemorrhage

### Abdominal Wall

- Benign and Malignant Tumours
- Hernia
- Infection
- Haemorrhage
- Vascular abnormalities

## General and Non-vascular intervention

### Core General and non-vascular intervention Training

To acquire basic clinical, pathological and radiological understanding of non-vascular interventional skills with reference to common presentations (Table GNVP)

Knowledge	Assessment Methods	GMP
Understand clinical significance of pathologies requiring intervention	2,4,5,6,7	1
Familiarity with conditions requiring tissue/fluid aspiration for diagnosis (culture, cytology and biochemical analysis)	2,4,5,6,7	1
Understand and deal appropriately with abnormalities of coagulation in relation to biopsies or interventional procedures	2,5,7	1
Understand the effect of drugs eg. aspirin, clopidogrel in relation to biopsies and interventional procedures	2,5,7	1
Understand when core biopsy is required for histology	2,4,5,6,7	1
Recognise common indications/contraindications to interventional procedures	2,4,5,6,,7	1
Recall basic anatomy in clinical practice relevant to imaging examinations of gastrointestinal tract, trauma, cancer	1,2,4,5,6,7	1
Familiarity with a range of needles, catheters and guidewires	2,4,5,7	1
Be aware of local/regional guidelines in relation to presentations	6,7	1
Skills		
Determine optimal imaging guidance	2,4,5,6,7	1
Assess the urgency of clinical situation	2,4,5,6,7	1
Recommend/perform protocols and interpret appropriate basic non invasive imaging; US, CT, MRI	2,4,5,6,7	1
Perform fine needle aspiration e.g. thyroid, lymph node, breast, lung	7	1
Perform fluid aspiration/drainage e.g. pleural, peritoneal, joint effusion/abscess	7	1
Perform core biopsy e.g. liver, solid organ, soft tissue	7	1
Collect and prepare specimen correctly	7	1
Perform image guided NG tube placement	7	1
Document procedure and detail aftercare in notes	7	1
Behaviour		
Recognise need for specialist opinion from other clinicians/radiologists	4,5,6,7	1,2
Apply/adhere to local/regional guidelines	6,7	1,2
Prioritise workload to respond to most urgent cases first	6,7	1
Communicate results rapidly	5,6,7	1,3
Involve seniors appropriately	6,7	1,3
Attend MDTs	8,11	1,3

### Table GNVP – General and non-vascular intervention

#### Common Presentations (Core)

- Fluid collections requiring aspiration or drainage
- Situations requiring tissue diagnosis
- Acute and chronic renal tract obstruction including renal colic and renal dysfunction
- Ureteric leak
- Biliary tract obstruction
- Nutritional Disorders
- Gastrointestinal tract obstruction

## Level 1 General and non-vascular intervention

To acquire detailed clinical, pathological and radiological understanding of non-vascular interventional skills with reference to presentations (Table GNVP) and common diagnoses (Table GNVD)

Knowledge	Assessment Methods	GMP
Recall and build upon normal and post-surgical anatomy relevant to image guided intervention examinations	6,7,10	1
Know common acute and chronic presentation of pathologies in different organ systems and how the clinical scenario affects management strategy	6,7,10	1
Recognise clinical sequelae of these conditions	6,7,10	1
Recognise the medical, interventional and surgical management options for these conditions	6,7,10	1
Understand the management of patients with contraindications to interventional procedure	6,7,10	1
Understand nutritional assessment and support	6,7	1
Knowledge of basic suturing techniques and wound care	7	1
Be aware of national IR audits and registries	6	1
Skills		
Perform clinical assessment of patients in ward and out-patient settings before and after interventions	7	1,2,3
Manage patients' drains e.g. monitoring output, skin care and exchange	7	1,2,3
Perform advanced nutritional procedures <ul style="list-style-type: none"> <li>NJ tube placement</li> <li>radiological insertion of gastrostomies/jejunostomies</li> <li>adjustment of gastric bands</li> </ul>	7	1,2,3
Increase skills in imaging guided intervention using ultrasound and CT		
Perform <ul style="list-style-type: none"> <li>nephrostomy</li> <li>percutaneous transhepatic drainage,</li> <li>percutaneous cholecystotomy</li> </ul>	7	1,2,3
Convert <ul style="list-style-type: none"> <li>nephrostomy to ureteric stent</li> <li>external biliary drain to internal biliary stent</li> </ul>	7	1,2,3
Perform basic suturing and wound care	7	1,2,3
Recognise and manage complications of interventional procedures	7	1,2,3
Organise and undertake appropriate follow up imaging	6,7	1,2,3
Undertake post-procedural follow-up of patients	8	1,2,3

<b>Behaviour</b>		
Formulate a plan for investigation and management	7	1,2
Initiate additional examinations as appropriate	7	1,2
Seek support from specialist nurse/radiographer practitioners	7,8	1,2,3
Request specialist opinion and assistance from other clinicians	7	1,2,3
Record performance data in local and national registries	7	1
Perform audit/research in intervention procedures	7,9	1,2
Seek additional clinical information relevant to case	7	1,2
Tailor procedure to clinical indication	7	1,2,3
Participate in MDTs	8,11	1,2,3
Take part in teaching and training	8,10	1

## Level 2 General and non-vascular intervention

To acquire detailed clinical, pathological and radiological understanding of non-vascular interventional skills with reference to presentations (Table GNV) and uncommon diagnoses (Table GNV2)

Knowledge	Assessment Methods	GMP
Understand in detail most acute clinical presentations and diagnoses	6,7,10	1
Know normal and variant anatomy (post-surgical anatomy) relevant to above	6,7,10	1
Recognise uncommon conditions	6,7,10	1
Know the expected outcomes of different diagnostic and therapeutic options	6,7,10	1
Understand indications and techniques for percutaneous tumour ablation	6,7,10	1
Be familiar with a range of interventional equipment – balloons, stents, feeding tubes	6,7,10	1
Understand the indications, contraindications and limitations of optical endoscopic examinations of the GI tract and their use in GI and biliary tract biopsy, drainage and stenting	6,7,10	1
Skills		
Perform plugged or transjugular biopsy in the presence of abnormal clotting	7	1,2,3
Perform retroperitoneal biopsy – lymph node, pancreas	7	1,2
Perform drainage of complex collections e.g. loculated collections, empyema, phlegmon	7	1,2,3
Perform advanced procedures in the urinary tract e.g. percutaneous nephrolithotomy and pyeloplasty	7	1,2,3
Perform advanced procedures in GI tract – balloon dilatation of strictures, stent insertion (oesophageal, duodenal, colonic)	7	1,2,3
Advanced procedures in the hepatobiliary system	7	1,2,3
Perform tumour ablation	7	1,2,3
Optional - Perform optical imaging procedures of the GI tract for GI and biliary tract biopsy, drainage and stenting	7	1,2,3
Perform vertebroplasty	7	1,2,3
Perform ablation of bone lesions	7	1,2,3
Perform fallopian tube recanalisation	7	1,2,3
Recognise and manage unusual complications	7	1,2,3
Take part in one stop clinics	7, 8	1,2,3
Take part in teaching and training at local and national level	10	1,2,3

<b>Behaviour</b>		
Highly organised work pattern	7,10	1,2,3
Automatically prioritise cases according to clinical need	7	1,2
Discuss/recommend management of complex cases with other clinicians	7	1,2,3
Quickly establish nature of clinical problem	6,7	1,2
Be able succinctly to relate clinical and imaging findings	6,7	1,2
Recognise National Guidelines and Standards of Practice eg. NICE, SIGN, RCR	6,7	1,2,3
Have an active role in interventional service delivery	6,7,10	1,2,3
Be able to accept referrals for imaging and intervention	7	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3

**Table GNVD –General and Non Vascular Intervention Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Fluid collections:**

- Pleural effusion
- Ascites
- Pelvic collection

**Infected fluid:**

- Abscess,
- Empyema

**Obstructed systems:**

- Biliary
- Renal tract
- Gastrointestinal tract

**Diffuse disease:**

- Liver
- Kidney
- Bone

**Renal Tract:**

- Stone disease
- Neoplasm
- Ureteric leak
- Post surgery
- Traumatic

**Biliary Tract:**

- Benign and Malignant strictures of the bile duct
- Intraductal stones
- Extrinsic obstruction
- Gall bladder: stones, empyema, cholangiocarcinoma

**Pancreas**

- Benign and Malignant strictures of the pancreatic duct
- Pancreatitis and complications
- Neoplasm

**Nutritional disorders**

**Gastrointestinal Tract:** benign and neoplastic strictures

- Oesophagus
- Duodenum
- Small Intestine
- Large Intestine

**Neoplasms:**

- Hepatobiliary
- Pancreatic
- Gastrointestinal Tract
- Genitourinary Tract
- Lung
- Bone

**Fallopian tube:**

- Occlusion and abnormalities

## Head and Neck Radiology

### Core Head and Neck Training

To acquire basic clinical, pathological and radiological understanding of head and neck disease with reference to common presentations (Table HP)

Knowledge	Assessment Methods	GMP
Understand clinical significance of pathology associated with presentation and link with likely diagnoses	2,4,5,6	1
Applied anatomy to interpret head and neck imaging	1,6	1
Understand role of radiology in the specific clinical setting	2,5,6	1
Local/regional guidelines in relation to presentations	2,6	1
Skills		
Determine optimal imaging examination	4,5,6	1
Plain x-ray interpretation and limitations	4,5,6	1
Perform and interpret imaging studies – swallows	6,7	1
Basic head and neck ultrasound	7	1
Basic CT/MRI interpretation and report presentations	6,7	1
<b>Intervention</b> – Ultrasound guided fine needle aspiration of cervical/supraclavicular lymph nodes	7	1,2
Behaviour		
Apply/adhere to local/regional guidelines	2,7	1,2
Prioritise workload to respond to most urgent cases first	6,7	1,2,3
Rapid communication of results	6,7	1,2,3
Appropriate involvement of seniors	8	1,2,3
Attend MDTs	8,11	1,2,3

**Table HP – Head and Neck Radiology Presentations**

Common Presentations (Core)
<ul style="list-style-type: none"> <li>• Orbital cellulitis / facial swelling with infection / acute sinusitis</li> <li>• Stridor</li> <li>• Trauma</li> <li>• Difficulty swallowing</li> <li>• Sensorineural hearing loss / tinnitus / vertigo</li> <li>• Lymphadenopathy</li> <li>• Thyroid masses</li> </ul>

## Level 1 Head and Neck Training

To acquire detailed clinical, pathological and radiological understanding of head and neck disease with reference to uncommon presentations and common diagnoses (Table HD1)

Knowledge	Assessment Methods	GMP
Recognise atypical presentations of common conditions	6,7,10	1
Skills		
Require minimal supervision with most cases	6,7	1
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7	1
Recognise how diagnosis affects management pathway	6,7	1
Intervention – FNA/core biopsy	7	1,2,3
Behaviour		
Seek additional clinical information relevant to case	6,7,8	1
Tailor examination to clinical indication	6,7	1
Initiate additional examination as appropriate	6,7	1,2
Formulate appropriate DDx	6	1,2
Participate in MDTs	8,11	1,2,3
Take part in teaching and training	8,10	1

**Table HD1 – Head and Neck Radiology Diagnoses**

Uncommon Presentations (Level1)
<ul style="list-style-type: none"> <li>• Other neck lumps</li> <li>• Epistaxis</li> <li>• Nerve palsies</li> <li>• Otagia</li> <li>• Atypical facial pain/ trigeminal neuralgia</li> <li>• Conductive hearing loss / discharging ear</li> <li>• Chronic sinusitis / nasal obstruction</li> <li>• Trismus</li> <li>• Hoarseness</li> <li>• Orbital masses / proptosis</li> <li>• Temporomandibular joint locking / clicking</li> <li>• Salivary gland symptoms</li> </ul>

Common Diagnoses (Level1)
<p><b>Temporal Bone</b></p> <ul style="list-style-type: none"> <li>• Trauma</li> <li>• Cholesteatoma and inflammatory disease</li> </ul>

## Common Diagnoses (Level1)

### Facial Skeleton/Skull Base

- Trauma
- Tumours 1<sup>o</sup> and 2<sup>o</sup>
- Cranial nerve pathologies

### Orbital/Visual pathways – involving orbital, ocular, lacrimal and neural causes

- Trauma
- Thyroid eye disease
- Common vascular
- Common neoplastic

### Sinuses

- Inflammatory
- Endoscopic related complications
- Neoplastic

### Lymph Nodes

- Infectious
- Inflammatory
- Neoplastic

### Congenital

- Branchial cleft cysts
- Thyroglossal duct cysts
- Lymphovenous malformations
- Dermoid cysts

### Upper Aerodigestive Tract

- Inflammatory
- Neoplastic
- Vocal cord palsy

### Dento-alveolar

- Inflammatory / infective

### Salivary Glands

- Sialiectasis
- Inflammatory / infective
- Benign and malignant neoplasia
- Ranula

### Thyroid

- Benign nodular disease
- Inflammatory/Autoimmune
- Neoplasia

## Level 2 Head and Neck Training

To acquire detailed clinical, pathological and radiological understanding of head and neck disease with reference to uncommon diagnoses (Table HD2)

Knowledge	Assessment Methods	GMP
Detailed understanding of clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant anatomy relevant to above	6,10	1
Familiarity with scintigraphy and PET/CT	6,10	1
Recognition of uncommon conditions mimicking common diagnoses	6,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6,7	1
Perform sialography and videofluoroscopy	6,7	1
Provide expert image interpretation	6	1
Be able accurately to report most cases	6	1
Write clear succinct reports which emphasise the key findings and diagnoses	6,8	1
<b>Intervention</b> –advanced biopsy techniques	7	1,2,3
Behaviour		
Highly organised work pattern	8	1,2,3
Automatically prioritise cases according to clinical need	6,8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,8	1,2,3
Quickly establish the clinical problem	6,7	1,3
Active role in service delivery	9	1,2,3
Assume a leadership role in multidisciplinary team meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3
Discuss with specialist centre appropriately	8	1,2,3

**Table HD2 – Head and Neck Radiology Diagnoses**

**Uncommon Diagnoses (Level 2)**

**Temporal Bone**

- Congenital and Embryological Anomalies
- Inflammatory disease
- Tumours
- Otospongiosis

**Facial Skeleton/Skull base**

- Congenital and Embryological Anomalies
- CSF leak

**Orbital/Visual pathways – involving orbital, ocular, lacrimal and neural causes**

- Uncommon Vascular
- Uncommon Neoplastic

**Sinuses**

- Congenital

**Upper Aerodigestive tract**

- Congenital  
Problems of Deglutition

**Dento-alveolar**

- Mandibular / maxillary cysts

**TMJs**

- Degenerative / arthritides
- TMJ dysfunction

**Parathyroid Glands**

- Neoplasia and hyperplasia

## Musculoskeletal Radiology

### Core Musculoskeletal Training

To acquire basic clinical, pathological and radiological understanding of musculoskeletal disease with reference to common presentations (Table MP)

Knowledge	Assessment Methods	GMP
Applied anatomy relevant to musculoskeletal disease and radiological diagnosis	1	1
Terminology relevant to MSK imaging	2,3,4,5,6	1
Role of different imaging modalities in MSK	1,2,4,5,7	1
Principles of bone and joint lesion characterisation	2	1
Awareness of tumour staging	2	1
Local/regional guidelines in relation to MSK presentations	2,7	1
Skills		
Link presentations with likely diagnoses	2,5,6	1,2
Determine optimal imaging examination	2,5,7	1,2
Plain x-ray interpretation and limitations	2,3,4,5,6	1,2
Perform basic MSK ultrasound e.g. common tendon injuries and joint effusions	7	1,2,3
Basic MSK CT interpretation and report for core presentations and diagnoses	2,3,4,5,6	1,2,3
Basic MSK MRI interpretation and report for core presentation	2,3,4,5,6	1,2,3
Decision making in relation to initial patient management	2,4,5,6,7	1,2,3,4
<b>Intervention</b> - US guided fluid aspiration	7	1,2,3
Behaviour		
Apply/adhere to local/regional guidelines	7,8	2,4
Prioritise workload to respond to most urgent cases first	8	1,2,3
Rapid communication of results	8	1,2,3
Appropriate involvement of seniors	8	1,2,3
Tailor examination to clinical indication	2,4,5,7	1,2,3
Attend MDTs	8,11	1,2,3

## Table MP – Musculoskeletal Radiology Presentations

### Common Presentations (Core)

- Bone/ Joint pain +/- trauma
- Spinal cord/cauda equina compression
- Spinal trauma
- Acute nerve root compression / sciatica
- Myelopathy/radiculopathy
- Spina bifida
- Scoliosis
- Acute and chronic injuries of tendons, muscles and ligaments
- Soft tissue/bony mass
- Musculoskeletal infection
- Incidental finding on plain radiograph

## Level 1 Musculoskeletal Training

To acquire detailed clinical, pathological and radiological understanding of musculoskeletal disease with reference to presentations (Table MP) and common diagnoses (Table MD)

Knowledge	Assessment Methods	GMP
Recognise all/atypical presentations of common conditions	6,10	1,2
Awareness of appropriate investigations in relation to MSK malignancy	6,10	1,2
Role of arthrography	7,10	1,2
Skills		
Require minimal supervision with most cases	7	1,2
Protocol & interpret MSK MRI	7	1,2
Interpret bone densitometry examinations	6	1,2
Recognise atypical appearances of common conditions	6	1,2
Perform MSK ultrasound of joints, muscles, tendons and soft tissue masses	7	1,2,3
Specialist CT & MRI including arthrography	7	1,2,3
Recognise clinical priority of MSK presentations	7,8	1,2,3
Recognise how diagnosis affects management pathway	7	1,2,3
Formulate appropriate DDx	6	1,2,3
Refer appropriately to previous imaging	6	1,2,3
Intervention		
<ul style="list-style-type: none"> <li>• Bone and soft tissue biopsy</li> <li>• Arthrography</li> <li>• Therapeutic joint and soft tissue injections</li> <li>• Aspiration and drainage procedures</li> <li>• Bone and soft tissue biopsy (following discussion with specialist centre)</li> <li>• Basic spinal techniques</li> </ul>	7	1,2,3,4
<b>Intervention</b> – Recognise and manage complications of biopsy	7	1,2,3,4
Behaviour		
Recognise/seek constellations of appearances which advance diagnosis	6	2,4
Timely communication of results	8	2,3,4
Defer to a senior/specialist colleague	8	2,3,4
Discuss with specialist centre appropriately	8	2,3,4
Seek additional clinical information relevant to case	6	2,3,4
Initiate additional examination as appropriate	6	2,3,4
Participate in MDTs	8,11	1,2,3
Take part in teaching and training	8,10	1
Be available and amenable to discussion with clinical colleagues	8	1,2,3,4

## Level 2 Musculoskeletal Training

To acquire detailed clinical, pathological and radiological understanding of musculoskeletal disease with reference to uncommon presentations and diagnoses (Table MD)

Knowledge	Assessment Methods	GMP
Detailed knowledge of normal and variant anatomy relevant to MSK	6,7,10	1,2
National/international guidelines and current literature	6,7,10	1,2
Recognition of uncommon conditions mimicking common diagnoses	6,10	1,2
Skills		
Interpret & perform complex MRI / CT	6	1,2
Provide expert opinion on appropriate patient imaging	6	1,2
Provide expert image interpretation	6	1,2
Be able accurately to report most cases	6	1,2
Write clear succinct reports which emphasise the key findings and diagnoses	6	1,2,3
<b>Intervention</b>	7	1,2,3
<ul style="list-style-type: none"> <li>• RF ablation of MSK pathology</li> <li>• Advanced spinal techniques</li> </ul>		
Behaviour		
Detailed understanding of most acute clinical presentations and diagnoses	6	1,2,3
Highly organised work pattern	8	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,8	1,2,3
Quickly establish clinical problem	6,8	1,2,3
Be able to relate clinical and imaging findings succinctly	6,8	1,2,3
Assume a leadership role in multidisciplinary MSK meetings	8,11	1,2,3,4
Offer timely specialist opinion	8	1,2,3
Participate in national teaching programmes	10	1,2,3
Attend international teaching programs	ePortfolio	1

**Table MD – Musculoskeletal Imaging Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Trauma (acute and chronic)**

- Fractures and dislocations
- Specific Bony/Joint Injuries
- Soft tissue Injuries

**Infection**

- Bone
- Joints
- Soft tissue

**Tumours/tumour-like lesions**

- Bone, primary/secondary
- Soft tissue

**Haematological**

- Haemoglobinopathies
- Myelofibrosis

**Metabolic, Endocrine, Toxic Disorders**

- Rickets
- Osteomalacia
- Hyperparathyroidism (primary and secondary)
- Osteoporosis

**Joint Disease/Arthropathies**

- Internal derangement
- Degenerative
- Inflammatory
- Crystal
- Masses arising from joints
- Neuropathies
- Complications of prosthetic joint replacement (hip and knee)

**Congenital, developmental and paediatric**

- Spine
- Shoulder
- Wrist and hand
- Hip

**Bone dysplasias**

## Diagnoses – Common/Uncommon (Level1/2)

### Spine

- Metastasis
- Infection, including TB, discitis, osteomyelitis, epidural abscess
- Spinal haematoma
- Spinal fractures and dislocations Degenerative disc disease
- Syringomyelia
- Intraspinous tumours
- Spinal dysraphism

### Miscellaneous

- Sarcoidosis
- Paget's disease
- Hypertrophic osteoarthropathy
- Transient/regional migratory osteoporosis
- Characterisation of soft tissue calcification

## Neuroradiology

### Core Neuroradiology Training

To acquire basic clinical, pathological and radiological understanding of diseases of the brain and spine with reference to common presentations (Table NP)

<b>Knowledge</b>	<b>Assessment Methods</b>	<b>GMP</b>
Applied anatomy relevant to cranial and spinal imaging examinations	1	1
Know the common causes of acute cranial pathology and their management	1,2,4,6	1
Know the common causes of acute spinal pathology and their management	1,2,4,6	1
<b>Skills</b>		
Interpret emergency CT and MRI of the head	4,5,6	1,2
Understand the imaging pathway in relation to intracranial pathology	2,4,5,6	1,2
Give a definitive report for straightforward cases and a provisional report for more complex findings	4,5,6	1,2
Interpret emergency radiographs, CT and MRI of the spine	4,5,6	1,2
Understand the imaging pathway in relation to acute spinal pathology	3,4,5,6	1,2
<b>Behaviour</b>		
Involve seniors as appropriate	4,5,6	1,2,3
Recognise need for timely specialist opinion	4,5,6	1,2,3
Attend relevant MDT	8,11	1,2,3

**Table NP – Neuroradiology Presentations**

**Common Presentations (Core)**

**Brain**

*Acute:*

- Acute headache
- Stroke
- Head trauma including NAI
- Hydrocephalus
- Painful Horner's syndrome
- Painful Third cranial nerve palsy
- Coma

*Non-acute:*

- Seizure
- Suspected multiple sclerosis
- Pituitary dysfunction
- Visual field defect
- Common cranial nerve palsies
- Sensorineural hearing loss
- Raised intracranial pressure
- Progressive headache

**Spine**

*Acute:*

- Suspected cord/cauda equina compression
- Trauma

*Non-acute:*

- Myelopathy and radiculopathy
- Spina bifida

## Level 1 Neuroradiology Training

To acquire detailed clinical, pathological and radiological understanding of diseases of the brain and spine with reference to presentations (Table NP) and common diagnoses (Table ND)

Knowledge	Assessment Methods	GMP
Detailed applied anatomy relevant to cranial and spinal imaging examinations	6,10	1
Know a wide range of intracranial pathologies, their imaging and clinical management	6,10	1
Know a wide range of spinal pathologies, their imaging and clinical management	6,10	1
Skills		
Interpret MRI examination	6	1
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7	1
Recognise how diagnosis affects management pathway	6,7	1
Provide a definitive report on neuroaxis CT and MRI	6	1
Supervise more complex examinations (e.g. CTA)	6	1,2
Perform biopsy of straightforward spinal lesions.	7	1,2,3
Behaviour		
Formulate a Management Plan	6	1,2
Involve seniors as appropriate	6	1,2,3
Participate in relevant MDT	8,11	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Neuroradiology Training

To acquire detailed clinical, pathological and radiological understanding of diseases of the brain and spine with reference to presentations (Table NP) and uncommon diagnoses (Table ND)

Knowledge	Assessment Methods	GMP
Identify the full range of intracranial and spinal pathologies	6,10	1
Outline the full clinical management of neurological and neurosurgical cranial and spinal conditions.	6,10	1
Knowledge of range of imaging studies relevant to neuroradiology and their role e.g. radionuclide studies, PET – CT, perfusion imaging, MR spectroscopy, myelography, spinal angiography	6,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6	1
Report and undertake more complex examinations	6	1
Provide expert opinion on appropriate patient imaging	6,7	1
Provide expert image interpretation	6	1
Perform biopsy of more complex spinal lesions	7	1,2,3
Take part in teaching and training at local and national level	10	1,3
Behaviour		
Recognise National Guidelines eg. NICE, SIGN	6,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1

**Table ND – Neuroradiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Brain**

*Acute:*

- Subarachnoid haemorrhage
- Intracranial aneurysm
- Venous sinus thrombosis
- Intracranial infection and complications (abscess, subdural empyema, herpes encephalitis, HIV)
- Carotid and vertebral artery dissection
- Cerebral infarction
- Intracranial haemorrhage
- Hydrocephalus

*Non-acute:*

- Common primary brain tumours
- Metastatic disease
- Pituitary tumours
- Craniopharyngioma and suprasellar masses
- Intracranial cysts
- Vestibular schwannoma
- Vascular malformations
- Demyelination and its differential diagnosis
- Common congenital disorders
- Cerebrovascular disease

**Spinal**

- Metastasis
- Infection, including TB, discitis, osteomyelitis, epidural abscess
- Spinal haematoma
- Spinal fractures and dislocations Degenerative disc disease  
Syringomyelia
- Intraspinial tumours
- Spinal dysraphism

## Oncological Radiology

### Core Oncology Training

To acquire basic clinical, pathological and radiological understanding of oncological disease with reference to common presentations (Table OP)

Knowledge	Assessment Methods	GMP
Applied anatomy to interpret oncology imaging	1,2,6	1
State typical pathways of spread of common tumours	2,4,5,6	1
Recall the common tumour staging nomenclature	2,5,6	1
Recall the application of imaging modalities in oncological practice	1,2,4,5,6	1
State the most common radiological manifestations of complications of cancer treatments	2,4,6	1
Local/regional guidelines in relation to cancer imaging	6	1,2
Awareness of TNM staging	2,4,5,6	1
Skills		
Determine optimal imaging examination relevant to oncology	2,4,5,6	1
Plain radiograph interpretation and limitations in cancer imaging	1,2,4,5,6	1
Perform and interpret pertinent staging and follow-up examinations of common tumours	5,6	1
Ultrasound in cancer patients	4,5,6	1
CT/MRI interpretation and reporting in common cancer presentations	4,5,6	1
Perform image-guided biopsy of readily accessible tumours	7	1
<b>Intervention</b> – see General and non vascular intervention	7	1,2,3
Behaviour		
Break bad news when required e.g. ultrasound	6,7,8	1,3
Apply/adhere to local/regional guidelines	5,6,7	1,2
Prioritise workload to respond to most urgent cases first	5,6,7,8	1
Rapid communication of results	5,6,7,8	1,3
Appropriate involvement of seniors	5,6,7,8	1,3
Attend MDT meeting	8,11	1,2,3

**Table OP – Oncological Radiology Presentations**

Common Presentations (Core)
<ul style="list-style-type: none"> <li>• New/known cancer (see organ specific content)</li> <li>• Cancer follow up</li> <li>• Paraneoplastic syndrome</li> <li>• Complication of therapy</li> </ul>

## Level 1 Oncology Training

To acquire detailed clinical, pathological and radiological understanding of oncological disease with reference to presentations (Table OP) and common diagnoses (Table OD)

Knowledge	Assessment Methods	GMP
State atypical presentations of common tumours	6,10	1
State pathways of spread of less common tumours	6,10	1
State patient factors and imaging features associated with increased morbidity and mortality	6,10	1
State the indications for advanced imaging techniques (e.g. Contrast US, MRS, DWI, Specific MR contrast agents and Nuclear medicine and PET/CT) in cancer imaging	6,10	1
State less common radiological manifestations of complications of treatment of cancer	6,10	1
Working knowledge of TNM staging	6,10	1
Local/regional guidelines	6,10	1,2
Recall the epidemiological aspects of common tumours	6,10	1
Skills		
Recognise atypical appearances of common cancers	6	1
Recognise/seek constellations of appearances which advance diagnosis	6	1
Recognise clinical priority of certain presentations	6,8	1
Recognise how diagnosis affects management pathway	6,8	1
Supervise and interpret follow-up examinations of less common tumours	6	1
Apply response assessment techniques	6	1,2
<b>Intervention</b> – Perform technically difficult targeted image-guided biopsy of neoplastic lesions	7	1,3
<b>Intervention</b> – Participate in a range of interventional cancer therapies	7	1,2,3
Behaviour		
Seek additional clinical information relevant to case	6	1
Tailor examination to clinical indication	6,8	1
Initiate additional examination as appropriate	6,8	1
Formulate appropriate DDx	6,8	1
Show understanding of the role of the multidisciplinary team in oncology practice	6,8	1,2,3
Participate in MDMs	8,11	1,2,3
Recognise National Guidelines e.g. NICE, SIGN	6,8	1,2,3
Defer to a senior/specialist colleague	8	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Oncology Training

To acquire detailed clinical, pathological and radiological understanding of oncological disease with reference to uncommon presentations and diagnoses (Table OD)

Knowledge	Assessment Methods	GMP
Detailed understanding of most clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant anatomy relevant to above	6,10	1
Recognition of uncommon conditions mimicking common diagnoses	6,10	1
Recall the detailed staging classification for different tumour types	6,10	1
Working knowledge of advanced specialist imaging investigations for particular tumour types (see level 1)	6,10	1
State a comprehensive range of the radiological manifestations of complications of treatment of cancer and approaches to their management	6,10	1
State the epidemiological aspects of tumours	6,10	1
State national guidelines and current literature	6,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6	1
Provide expert image interpretation	6	1
Write clear succinct reports which emphasise the key findings and diagnoses, relevant prognostic and management details	6,8	1
Continuing accreditation of intermediate life support/progression to advanced life support	certification	1
Report specialist imaging examinations (e.g. Perfusion studies, MRS, DWI, PET/CT (including SUV))	6	1
Support Clinical Oncologists in radiotherapy planning	6,10	1,2,3
<b>Intervention</b> – Perform technically difficult targeted image-guided biopsy of neoplastic lesions	7	1
<b>Intervention</b> – Undertake advanced interventional cancer therapies e.g. embolisation +/- chemo, RFA	7	1,3

<b>Behaviour</b>		
Highly organised work pattern	8	1
Automatically prioritise cases according to clinical need	6,8	1
Be able to discuss complex cases with referring clinicians and colleagues	8	1,3
Quickly establish clinical problem	6,8	1
Be able succinctly to relate clinical and imaging findings	6,7	1
Apply detailed knowledge of response assessment techniques including RECIST, irRC	6,7	1,2
Engage in research; active involvement in Oncology Trials	8	1,2
Proactively engage with national guideline operation and development e.g. NICE, SIGN	8	1,2,3
Assume a leadership role in multidisciplinary oncology meetings	8,11	1,3
Offer timely specialist opinion	6,8	1,3
Discuss with specialist centre appropriately	6,8	1,3

**Table OD – Oncological Radiology Diagnoses**

<b>Diagnoses – Common/Uncommon (Level1/2)</b>
<p><b>Benign and Malignant Tumours</b></p> <ul style="list-style-type: none"> <li>• Breast</li> <li>• Cardiac</li> <li>• Chest</li> <li>• GI</li> <li>• Head and Neck</li> <li>• MSK</li> <li>• Neurological</li> <li>• Urological/Gynaecological</li> <li>• Haematological</li> <li>• Other</li> </ul>

## Paediatric Radiology

### Core Paediatric Training

To acquire basic clinical, pathological and radiological understanding of paediatric diseases with reference to common presentations (Table PP)

Knowledge	Assessment Methods	GMP
Understand clinical significance of pathology associated with presentation and link with likely diagnoses	2,5,6,7	1
Applied anatomy and physiology to interpret paediatric imaging	1	1
Understand role of radiology in the specific clinical paediatric setting	6,7	1
Local/regional/national guidelines in relation to presentations	2,7	1
Skills		
Determine optimal imaging examination	2,4,5,6,7	1
Plain x-ray interpretation and limitations	3,4,5,6	1
Perform and interpret contrast imaging studies	6,7	1
Basic abdominal ultrasound	4,5,6,7	1
Basic CT and MRI in paediatric practice	4,5,6,7	1
Behaviour		
Apply/adhere to local/regional guidelines	6,7	1,2
Prioritise workload to respond to most urgent cases first	6,7	1
Rapid communication of results	6,7,8	1,3
Appropriate involvement of seniors	6,7,8	1,3
Attend MDTs	8,11	1,2,3

**Table PP – Paediatric Radiology Presentations**

Common Presentations (Core)
<ul style="list-style-type: none"> <li>• Abdominal pain, vomiting or mass</li> <li>• Cough, Breathlessness, Wheeze, Stridor</li> <li>• Precocious/delayed puberty, ambiguous genitalia, failure to thrive</li> <li>• Limp</li> <li>• Childhood Abuse/Non Accidental Injury</li> <li>• UTI/haematuria/testicular pain</li> <li>• Pelvic pain, mass, ambiguous genitalia</li> <li>• Headache, diplopia, epilepsy, back pain or paralysis</li> </ul>

## Level 1 Paediatric Training

To acquire detailed clinical, pathological and radiological understanding of paediatric diseases with reference to presentations (Table PP) and common diagnoses (Table PD)

Knowledge	Assessment Methods	GMP
Recognise atypical presentations of common conditions	6,10	1
Skills		
Require minimal supervision with most cases	6,7	1
Recognise atypical appearances of common conditions	6,7	1
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7	1
Recognise how diagnosis affects management pathway	6,7	1
Basic paediatric CT/MRI supervision and reporting	6,7	1
Behaviour		
Seek additional clinical information relevant to case	6,7,8	1
Tailor examination to clinical indication	6,7	1
Initiate additional examination as appropriate	6,7	1
Formulate appropriate DDx	6,7	1
Participate in MDTs	8,10,11	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Paediatric Training

To acquire detailed clinical, pathological and radiological understanding of paediatric diseases with reference to uncommon presentations and diagnoses (Table PD)

Knowledge	Assessment Methods	GMP
Detailed understanding of most clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant anatomy relevant to above	6,7,10	1
Recognition of uncommon conditions mimicking common diagnoses	6,10	1
Skills		
Provide expert opinion on appropriate patient imaging	6,7,8	1
Provide expert image interpretation	6,7,8	1
Be able accurately to report most cases	6	1
Write clear succinct reports which emphasise the key findings and diagnoses	6,7,8	1
<b>Intervention</b> – see General and non vascular intervention	7	1,3
<b>Intervention</b> – reduction of intussusception	7	1,3
Behaviour		
Highly organised work pattern	6,7	1
Automatically prioritise cases according to clinical need	6,7	1
Be able to discuss complex cases with referring clinicians and colleagues	6,7,8	1
Quickly establish clinical problem	6,7	1
Be able succinctly to relate clinical and imaging findings	6,7	1
Show awareness of international relevant guidelines	6,7	1
Have an active role in service delivery	6,7,8	1
Assume a leadership role in multidisciplinary paediatric meetings	8,10,11	1,3
Offer timely specialist opinion	6,7,8	1,2
Discuss with specialist centre appropriately	7,8	1,2,3

**Table PD – Paediatric Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Neurological Disease**

- Trauma: skull and facial injury
- Intracranial injury, including Child abuse
- Infection of the brain, meninges, orbits and sinuses
- Hydrocephalus
- Tumours of the brain, orbits and spinal cord
- Premature brain
- Congenital malformation of brain and spinal cord
- Spinal cord injury

*Developmental anomalies*

- Migrational disorders
- Craniofacial malformations including craniostenosis
- Congenital ear disease
- Dental radiology

**Trauma**

- Fracture including NAI
- Sports Injury e.g. avulsion or enthesopathy
- Soft tissue injury
- Foreign body

**Congenital Dysplasias**

**Bone disorders**

- Legg-Calvé-Perthes disease
- Slipped upper femoral epiphysis
- Infection of bone, joint or soft tissue
- Arthritis
- Metabolic / haematological disease
- Tumours – benign/ malignant/ primary / secondary

**Chest**

*Cardiovascular System*

- Congenital heart disease
- Acquired heart disease
- Cardiac failure

*Diseases of the tracheobronchial tree, lungs and pleura*

- Infection (including TB)
- Pulmonary abscess
- Infiltrative lung disease
- Opportunistic infection in immunocompromised children
- Bronchiectasis

## Diagnoses – Common/Uncommon (Level1/2)

- Pleural effusion and empyema
- Pneumothorax
- Complications of asthma
- Premature lung disease and its complications
- Inhaled foreign bodies
- Mass lesions including congenital bronchopulmonary and foregut malformations
- Metastatic lung disease
- Chest trauma

### *Mediastinum*

- Mediastinal mass in children

### *Diaphragm*

- Diaphragmatic paralysis
- Eventration

### **GIT: Congenital e.g.**

- Oesophageal atresia
- Tracheo-oesophageal fistula
- Malrotation and situs anomalies
- Duodenal obstruction (e.g. atresia and stenosis)
- Hirschsprung's Disease
- Duplication anomalies

### **GIT: Acquired e.g.**

- Meconium ileus
- Meconium plug syndrome
- Pyloric stenosis
- Intussusception
- Inflammatory bowel disease
- Appendicitis
- Gastroenteritis

### **HPB**

- Choledocholithiasis in children
- Congenital malformations of the biliary tree
- Trauma
- Hepatobiliary tumours

### **Spleen**

- Trauma
- Haematological diseases
- Congenital syndromes associated with asplenia, polysplenia, etc.

## Diagnoses – Common/Uncommon (Level1/2)

### Pancreas

- Trauma
- Pancreatitis
- Congenital malformations

### Renal

- Congenital malformations
- Renal Cystic disease
- Hydronephrosis/hydronephrosis
- Reflux
- Infection
- Renal and bladder tumour
- Neuropathic bladder
- Trauma

### Adrenal

- Tumour

### Testes

- Scrotal trauma
- Testicular torsion
- Epididymo-orchitis
- Testicular tumours
- Undescended testes

### Gynaecology

- Ovarian cysts, possible torsion
- Neonatal presentation of ovarian cysts and hydro(metro)colpos genital and extragenital tumours
- Cloacal and urogenital sinus anomalies
- Intersex anomalies arising in the neonate and at adolescence
- Congenital uterine malformation
- Precocious and delayed puberty

### Endocrine Disease

- Thyroid disorders in children
- Adrenal disorders in children including neuroblastoma
- Growth abnormalities and suspected growth hormone deficiency

### Miscellaneous Multi-Organ Conditions

- Non-accidental injury (NAI)
- AIDS in children
- Lymphoma in children
- Vascular malformations including lymphoedema
- Collagen vascular disease including myofibromatosis

**Diagnoses – Common/Uncommon (Level1/2)**

- Phakomatoses (tuberous sclerosis, neurofibromatosis, etc.)
- Langerhans' Cell Histiocytosis

## Radionuclide Radiology

### Core Radionuclide Radiology Training

To acquire basic clinical, pathological and radiological understanding of radionuclide imaging with reference to common presentations.

Knowledge	Assessment Methods	GMP
Basic science – for physics and mathematics refer to Part 1 FRCR curriculum	1	1
Role of common radiopharmaceuticals currently available	2,6	1
Understand the principles and indications of commonly performed radionuclide studies and relation to other imaging investigations (refer to specific systems)	2,4,5,6	1
Describe patient preparation, precautions and complications of commonly performed investigations	2,4,5,6	1
Role of hybrid technologies such as SPECT CT and PET CT	2,4,5,6	1
Skills		
Demonstrate the ability to translate regulatory framework into local practice	2,4,5,6	1
Safe handling of radiopharmaceuticals	2,4,5,6,7	1,2
Interpretation of normal and abnormal results of commonly performed investigations across all clinical systems.	2,4,5,6,7	1,2
Behaviour		
Recognise the need to understand the basic science and cellular biology appropriate to radionuclide radiology and PET CT	6,7	1
Be willing to learn new skills and keep up to date with latest technology	6,7	1,2,3
Appreciate the importance of safe handling of radiopharmaceuticals for self and others	2,4,5,6,7	1,2,3
Attend MDTs	8,11	1,3

## Level 1 Radionuclide Radiology Training

To acquire a fundamental clinical, pathological and radiological understanding of a wide range of radionuclide investigations with reference to presentations and common diagnoses.

Independent reporting of bone, lung and renal imaging.

Evaluate and present complex investigations such as PET-CT and SPECT /CT across the curriculum.

Option to complement other system based expertise.

Knowledge	Assessment Methods	GMP
<b>Basic science</b>		
Basic statistics	6	1
Quantitative imaging and basic modelling	6	1
Radiation dose from radiopharmaceuticals	6	1
Management of radiation accidents relating to radionuclide radiology	6,10	1
Principles of Quality Assurance	6,10	1
<b>Regulatory framework</b>		
Appreciation of legislative frameworks	10	1
<b>Clinical Application for each system</b>		
Appropriate anatomy, physiology, pathophysiology and biochemistry of system under investigation	6,10	1
Indication for specific radiotracers including sensitivity and specificity	6,10	1
Role of comparative imaging tests	6,10	1
Radiation protection issues for each choice of tracer	6,10	1
Role of PET CT in staging of malignancies	6,10	1
<b>System specific knowledge – CNS</b>		
Radiopharmaceuticals for use in CNS imaging, e.g. cerebral blood flow, blood-brain barrier and neuroreceptor imaging	6,10	1
<b>System specific knowledge – Endocrine</b>		
Adrenal, Thyroid and Parathyroid imaging and uptake measurements where appropriate	6,10	1
<b>System specific knowledge – Gastrointestinal</b>		
Include salivary gland imaging, gastrointestinal transit studies, gastrointestinal blood loss, Meckel's diverticulum imaging, hepatic and hepatobiliary studies	6,10	1
<b>System specific knowledge – Infection and Inflammation</b>		
Basic science of infection/inflammation including cellular mechanisms	6,10	1
Clinical spectrum of occult sepsis	6,10	1
<b>System specific knowledge – Lymphoscintigraphy</b>		
Lymphoedema evaluation and Sentinel node localisation	6, 10	1
Mechanisms of tumour spread and concept of the sentinel node	6,10	1

Knowledge (continued)	Assessment Methods	GMP
<b>System specific knowledge – Oncology</b>		
Imaging tumour sites using radionuclide techniques including introductory PETCT & Hybrid imaging	6,10	1
<b>System specific knowledge – Ophthalmic System</b>		
Nasolacrimal drainage	6,10	1
<b>System specific knowledge – Paediatrics</b>		
Imaging children using radionuclides	6,10	1
Understand the growth and maturation in children with special reference to the handling of radiotracers by immature organs	6,10	1
Specific indications in children especially of the renal tract, biliary tract and skeleton	6,10	1
<b>System specific knowledge – Pulmonary System</b>		
Pulmonary embolism, regional ventilation, mucociliary and small solute clearance	6,7,10	1
Clinical risk factors and presentation of PE	6, 10	1
Indications for and evidence base supporting ventilation perfusion imaging	6, 10	1
Contribution of D-dimer measurements and leg Doppler studies and role of CTPA	6, 10	1
Clinical features and management of obstructive pulmonary disease, bronchiectasis and alveolitis and relation to imaging	6, 10	1
<b>System specific knowledge – Skeletal System</b>		
Bone and bone marrow scans	6, 10	1
<b>System specific knowledge – Urogenital System</b>		
Renal and bladder function	6, 10	1
<b>System specific knowledge – Cardiovascular System</b>		
Myocardial perfusion imaging, infarct imaging and radionuclide ventriculography	6, 10	1
Principles of myocardial perfusion and SPECT imaging	6, 10	1
<b>PET CT – Basic Science</b>		
Theory of production and decay of positron radionuclides used in Clinical PET CT	6, 10	1
Dosimetry of the various tracers used	6, 10	1
SUV quantification, variables and errors associated with quantitative measurements	6, 10	1
Physiology and patient preparation; fasting, diabetes, use of sedation	6, 10	1

Knowledge (continued)	Assessment Methods	GMP
<b>PET CT – Role in Oncology</b>		
Normal and physiological variation in tracer distribution and overlap with benign conditions producing FDG uptake	6, 10	1
Effect of chemotherapy and radiotherapy	6, 10	1
Role in tumour diagnosis, staging and recurrence	6, 10	1
Role with respect to comparative imaging	6, 10	1
<b>Molecular and functional imaging</b>		
Relationship between modalities such as MR, Spectroscopy, DNA probes etc.	10	1
<b>Skills</b>		
<b>Basic Science</b>		
Practical experience with monitoring devices, probes, dose calibrators, gamma cameras and positron emission tomography systems	7	1
Safe handling and administration of radiopharmaceuticals	7	1
Practical management of radioactive contamination	7	1
<b>Clinical Application</b>		
Preparation of patient prior to the test	7	1
Choice of radiopharmaceutical	7	1
Radiotracer preparation and its quality assurance	7	1
Measurement and drawing up of tracer	7	1
Radiopharmaceutical injection	7	1
Audit outcome of studies	9	1
Review of sequential data on patients and comparison with other methods of assessments	6	1
<b>System Specific Skills – Endocrine</b>		
Utility of intra-operative probe detection of parathyroids	7	1
<b>System Specific Skills – Lymphoscintigraphy</b>		
Surface localisation of the sentinel node	7	1
Calibration and use of the hand help probe	7	1
<b>System Specific Skills – Cardiovascular System</b>		
Setting up of instrumentation prior to ECG-gating and SPECT acquisition	7	1
Perform physiological or pharmacological stress prior to myocardial perfusion studies	7	1
Techniques of tomographic reconstruction, qualitative and quantitative analysis	7	1

Skills (continued)	Assessment Method	GMP
<b>System Specific Skills- PET-CT</b>		
Image interpretation and reporting including normal variants, artefacts, sources of error and assessment of utility	6,7	1
Audit outcome of studies	9	1
Review of sequential data on patients and comparison with other methods of assessment	6	1
<b>Behaviour</b>		
<b>Basic Science</b>		
Aseptic technique	7	1,2
Recognise need to work with others	7,8	1,2,3
Comply with current regulations	7,8	1,2,3
<b>Clinical Application</b>		
Vetting of requests	6	1,2
Show willingness to provide explanation	7	1,3
Appreciate the importance of timely reporting and accurate communication of the result to the referring clinician	6,7	1,2,3
Consider the importance of audit in the outcome of results	9	1,2
Show openness to critical feedback of reports	6,7	1,3
Appreciate the importance of keeping up-to-date with developments and with relevant medical literature	6,7	1,2
Show awareness of health and safety issues	6,7	1,2
Participate in MDTs	8,11	1,3
Take part in teaching and training	8,10	1

## Level 2 Radionuclide Radiology Training

To acquire detailed clinical, pathological and radiological understanding of radionuclide imaging with reference to presentations and common diagnoses.

Knowledge	Assessment Methods	GMP
<b>Basic science</b>		
Parametric and non-parametric statistics	6	1
Modelling tracer kinetics and quantitative imaging	6	1
Calculation of radiation dose from radiopharmaceuticals (effective dose)	6	1
Management of radiation accidents relating to radionuclide radiology	6,10	1
Physicochemical and biological properties of less common radiopharmaceuticals and those under development	6,10	1
Cell labelling techniques	6,10	1
Principles of Quality Assurance in the radiopharmacy	6,10	1
Quality control parameters determining the quality of radiopharmaceuticals including radionuclide and radiochemical purity	6,10	1
<b>Regulatory Frameworks</b>		
Understanding of UK regulatory frameworks relating to practice of radionuclide radiology	6,10	1
<b>Clinical Application for each system</b>		
Appropriate anatomy, physiology, pathophysiology and biochemistry of system under investigation	6,10	1
Indication for specific radiotracers including sensitivity and specificity	6,10	1
Role of comparative imaging tests	6,10	1
Radiation protection issues for each choice of tracer	6,10	1
Role of PET CT in staging of malignancies	6,10	1
<b>System specific knowledge –CNS</b>		
Radiopharmaceuticals for use in CNS imaging, eg cerebral blood flow, blood-brain barrier and neuroreceptor imaging	6,10	1
<b>System specific knowledge – Endocrine</b>		
Adrenal, Thyroid and Parathyroid imaging and uptake measurements where appropriate	6,10	1
Clinical presentation of thyroid disease	6,10	1
Role of complementary investigations including thyroid biochemistry and immunology	6, 10	1
Imaging of endocrine tumours e.g. carcinoid, APUD	6,10	1
Familiar with use of intra-operative probe detection of parathyroids	6,10	1

Knowledge (continued)	Assessment Methods	GMP
<b>System specific knowledge – Gastrointestinal</b>		
Include salivary gland imaging, gastro-oesophageal reflux, gastrointestinal transit studies, gastrointestinal blood loss, Meckel's diverticulum imaging, hepatic, hepatobiliary and splenic function assessment	6,10	1
Imaging of inflammatory bowel disease	6,10	1
<b>System specific knowledge – Infection and Inflammation</b>		
Basic science of infection/inflammation including cellular mechanisms	6,10	1
Clinical spectrum of occult sepsis	6,10	1
<b>System specific knowledge – Lymphoscintigraphy</b>		
Lymphoedema evaluation and Sentinel node localisation	6, 10	1
Mechanisms of tumour spread and concept of the sentinel node	6,10	1
Familiar with hybrid imaging techniques	6,10	1
<b>System specific knowledge – Oncology</b>		
Imaging tumour sites using radionuclide techniques, including PET- CT	6,10	1
Role in diagnosis, staging, localisation, therapy and monitoring response to treatment	6,10	1
Role in relation to other imaging techniques	6,10	1
<b>System specific knowledge – Ophthalmic System</b>		
Nasolacrimal drainage	6,10	1
<b>System specific knowledge – Paediatrics</b>		
Imaging children using radionuclides	6,10	1
Understand the growth and maturation in children with special reference to the handling of radiotracers by immature organs	6,10	1
Specific indications in children especially of the renal tract, biliary tract and skeleton	6,10	1
Knowledge of statutory issues relating to children (eg Children's Act)	6, 10	1
Principles of consent in children	6,7	1
<b>System specific knowledge – Pulmonary System</b>		
Pulmonary embolism, regional ventilation, mucociliary and small solute clearance	6,7,10	1
Clinical risk factors and presentation of PE	6, 10	1
Indications for and evidence base supporting ventilation perfusion imaging	6, 10	1
Contribution of other diagnostic tests and imaging techniques, including D-dimer measurements, leg Doppler studies and role of CTPA	6, 10	1
Role of radionuclide studies in the management of obstructive pulmonary disease, bronchiectasis and alveolitis	6, 10	1

Knowledge (continued)	Assessment Methods	GMP
<b>System specific knowledge – Skeletal System</b>		
Bone and bone marrow scans	6, 10	1
<b>System specific knowledge – Urogenital System</b>		
Renal and bladder function	6, 10	1
Renography for renovascular disease and role of other imaging studies	6, 10	1
Role of radionuclide studies in investigation of paediatric UTI and role of other imaging studies	6, 10	1
<b>System specific knowledge - Cardiovascular System</b>		
Myocardial perfusion imaging, infarct imaging and radionuclide ventriculography	6, 10	1
Principles of myocardial perfusion and SPECT imaging	6, 10	1
Imaging protocol used to evaluate myocardial viability, ischaemia and function	6, 10	1
Role of other diagnostic tests and imaging studies relevant to cardiology	6, 10	1
<b>PET CT – Basic Science</b>		
Theory of production and decay of positron radionuclides used in Clinical PET and PET CT	6, 10	1
Compartment analysis methods	6, 10	1
Appropriate mathematics and physics applied to PET tracer theory, modelling of tracer kinetics and quantitative imaging	6, 10	1
Radiopharmacy of the tracers used in PET	6, 10	1
Physiological principles of the techniques	6	1
Dosimetry of the various tracers used	6, 10	1
Legal aspects associated with tracers	6, 10	1
Methods of measurement of tracer activity and imaging equipment required	6, 10	1
SUV quantification, variables and errors associated with quantitative measurements	6, 10	1
Understand equipment and dedicated PET and PET CT systems	6, 10	1
Method of acquiring PET and PET CT images	6, 10	1
Cyclotron physics	6, 10	1
Physiology and patient preparation; fasting, diabetes, use of sedation	6, 10	1
<b>PET CT – Role in Oncology</b>		
Basic science of tumour metabolism	6, 10	1
Normal and physiological variation in tracer distribution and overlap with benign conditions producing FDG uptake	6, 10	1
PET tracers used for tumour detection	6, 10	1
Effect of chemotherapy and radiotherapy	6, 10	1
Role in tumour diagnosis, staging and recurrence	6, 10	1

Knowledge (continued)	Assessment Methods	GMP
Role with respect to comparative imaging	6, 10	1
<b>PET CT – Role in Neuropsychiatry</b>		
Normal variation of PET tracer within the brain	6, 10	1
Role in the diagnosis of common brain disorders such as epilepsy and dementia	6, 10	1
Role in the evaluation of brain tumours	6, 10	1
Role with respect to comparative imaging	6, 10	1
<b>PET CT – Role in Cardiology</b>		
FDG PET for assessment of myocardial viability	6, 10	1
Assessment of myocardial ischaemia using other PET tracers e.g. Rb – 82, N-13 ammonia, O-15 water	6, 10	1
Principles of pharmacological stress tests	6, 10	1
Control and monitoring of glucose metabolism for FDG injection	6, 10	1
Role with respect to comparative imaging	6, 10	1
<b>Functional and Molecular Imaging</b>		
Relationship of radionuclide imaging to other functional imaging techniques e.g. functional MRI, spectroscopy, perfusion imaging and diffusion weighted imaging	6,10	1
<b>Skills</b>		
<b>Basic Science</b>		
Practical experience with monitoring devices, probes, dose calibrators, gamma cameras and positron emission tomography systems	7	1
Safe handling and administration of radiopharmaceuticals	7	1
Demonstrate ability to handle incidents of radioactive spillage or contamination	7	1
<b>Clinical Application</b>		
Preparation of patient prior to the test	7	1
Choice of radiopharmaceutical	7	1
Radiotracer preparation and its quality assurance	7	1
Measurement and drawing up of tracer	7	1
Radiopharmaceutical injection	7	1
Choice of protocols	7	1
Be familiar with setting up of instrumentation, choice of collimator and performance of scan	7	1
Be familiar with data processing, image reconstruction, quantification and image display	6,7	1
Image interpretation and reporting (including PET CT) including normal variants, artefacts, sources of error and assessment of utility	6,7	1

Skills (continued)	Assessment Method	GMP
<b>Clinical Application (continued)</b>		
Audit outcome of studies	9	1
Review of sequential data on patients and comparison with other methods of assessments	6	1
<b>System Specific Skills – Endocrine</b>		
Clinical examination of the thyroid	7	1
Correlation of the scan and clinical findings	7	1
<b>System Specific Skills – Lymphoscintigraphy</b>		
Surface localisation of the sentinel node	7	1
Calibration and use of the hand held probe	7	1
<b>System Specific Skills – Cardiovascular System</b>		
Setting up of instrumentation prior to ECG-gating and SPECT acquisition	7	1
Perform physiological or pharmacological stress prior to myocardial perfusion studies	7	1
Familiar with techniques of tomographic reconstruction, filter selection and qualitative and quantitative analysis	6,7	1
<b>Role of PET CT</b>		
Preparation of patient prior to the test	7	1
Choice of radiopharmaceutical	7	1
Measurement and drawing up of tracer	7	1
Radiopharmaceutical injection	7	1
Setting up of instrumentation, choice of collimator and performance of scan	7	1
Data processing, image reconstruction, quantification and image display	7	1
Image interpretation and reporting (including PET CT) including normal variants, artefacts, sources of error and assessment of utility	7	1
Audit outcome of studies	9	1
Review of sequential data on patients and comparison with other methods of assessments	6	1

Behaviour	Assessment Method	GMP
<b>Basic Science</b>		
Show attention to detail in handling radiopharmaceuticals, ensuring purity and aseptic technique	7	1,2
Recognise need to work with others in ensuring regulations are adhered to	7,8	1,3
<b>Clinical Application</b>		
Recognise the importance of proper vetting of requests	6	1,2
Show willingness to provide explanation	7	1,3
Appreciate the importance of timely reporting and accurate communication of the result to the referring clinician	6,7	1,2,3
Consider the importance of audit in the outcome of results	9	1,2
Show openness to critical feedback of reports	6,7	1,3
Appreciate the importance of keeping up-to-date with developments and with relevant medical literature	6,7	1,2
Show awareness of health and safety issues	6,7	1,2
Lead MDTs	8,11	1,3
<b>Role of PET CT</b>		
Recognise the importance of proper vetting of requests	6	1,2
Show willingness to provide explanation	7	1,3
Appreciate the importance of timely reporting and accurate communication of the result to the referring clinician	6,7	1,2,3
Consider the importance of audit in the outcome of results	9	1,2,3
Show openness to critical feedback of reports	6,7	1,3
Appreciate the importance of keeping up-to-date with developments and with relevant medical literature	6,7	1,2,3
Show awareness of health and safety issues	7,8	1,2,3
Lead MDTs	8,11	1,3

## Thoracic Radiology

### Core Thoracic Training

To acquire basic clinical, pathological and radiological understanding of thoracic disease with reference to common presentations (Table TP)

Knowledge	Assessment Methods	GMP
Applied anatomy relevant to thoracic disease and radiological diagnosis including the pulmonary lobule	1	1
Role of Chest Radiograph	6,10	1
Role of CT	6,10	1
Terminology relevant to thoracic imaging (Fleischner Society Glossary 2008)	2	1
Appearance and positioning of lines, tubes and devices	2,4,5,6	1
Techniques and subsequent imaging appearances of thoracic surgery	6,10	1
Awareness of TNM staging in thoracic malignancy	5,6	1
Local/regional guidelines in relation to clinical presentations	6	1
Skills		
Link presentations with likely diagnoses	2,5,6	1,2
Determine optimal imaging examination taking account of clinical indication and implications	5,6	1,2
Chest radiographic interpretation and limitations	4,5	1,2
Construct reasoned and succinct differential diagnoses	4,5,6	1,2
Identify and characterise basic signs of thoracic disease: collapse, consolidation, pneumothorax, pleural vs. parenchymal disease on CXR and CT	3,4,5,6	1,2
Diagnosis of PE on V/Q and CT	3,4,5,6	1,2
US of the chest and thoracic inlet, for the diagnosis of pleural fluid versus collapse or consolidation, pneumothorax and diaphragmatic weakness and paralysis	6,7	1,2
Intervention		
<ul style="list-style-type: none"> <li>Image guided pleural drainage</li> <li>Fine needle aspiration of cervical/supraclavicular lymph nodes</li> </ul>	7	1,2,3
Behaviour		
Apply/adhere to local/regional guidelines	6,7	1,2,3
Prioritise workload to respond to most urgent cases first	6,7,8	1,2,3,4
Rapid communication of results	6,7,8	1,2,3
Appropriate involvement of seniors	6,7,8	1,2,3
Attend MDM	8,11	1,2,3

### Table TP – Thoracic Radiology Presentations

#### Common Presentations (Core)

- Chest pain
- Breathlessness
- Cough
- Fever
- Febrile neutropenia
- Haemoptysis
- Wheeze
- Hoarseness / stridor
- Erythema Nodosum
- Incidental finding on CXR
- Incidental finding on Chest CT
- Trauma

## Level 1 Thoracic Training

To acquire detailed clinical, pathological and radiological understanding of thoracic disease with reference to presentations (Table TP) and common diagnoses (Table TD)

Knowledge	Assessment Methods	GMP
Detailed knowledge of normal and variant anatomy relevant to thoracic disease	6,10	1
Recognise atypical presentations of common conditions	6,10	1
Understanding of the imaging algorithms for common pulmonary diseases and their rationale: <ul style="list-style-type: none"> <li>Management of the solitary pulmonary nodule (Fleischner Society Guidelines 2005)</li> <li>Investigation of suspected pulmonary embolism; investigation of suspected lung cancer</li> </ul>	6,10	1
Working knowledge of current TNM staging system in thoracic malignancy	6,10	1
Role of MRI	6,10	1
Role of PET-CT	6,10	1
Role of EBUS/EUS	6,10	1
Role of airway stenting	6,10	1
Skills		
Require minimal supervision with most cases	6,8	1,2
Protocol & interpret thoracic MRI	6,8	1
Recognise atypical appearances of common conditions	6	1
Recognise/seek constellations of appearances which advance diagnosis	6	1,2
Diagnose lung diseases on HRCT	6	1
Recognise clinical priority of certain presentations	6,8	1,2
Recognise how diagnosis affects management pathway	6,8	1,2,3
Formulate appropriate DDx	6	1,2,3
Clear and accurate consent for thoracic procedures	7	1,2,3,4
<b>Intervention</b> – US and CT guided lung and pleural biopsy	7	1,2,3
<b>Intervention</b> – Recognise and manage complications of biopsy	7	1,2,3
Behaviour		
Timely communication of results	6,7,8	1,2,3
Defer to a senior/specialist colleague	6,7,8	1,2,3,4
Seek additional clinical information relevant to case	6,7	1,2,3
Tailor examination to clinical indication	6	1,2,3
Initiate additional examination as appropriate	6	1,2,3
Participate in MDM	8,11	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Thoracic Training

To acquire detailed clinical, pathological and radiological understanding of thoracic disease with reference to uncommon presentations and diagnoses (Table TD)

Knowledge	Assessment Methods	GMP
Epidemiology of lung diseases	6,10	1
Lung cancer screening	6,10	1
National/international guidelines and current literature	6,10	1
Recognition of uncommon conditions mimicking common presentations/diagnoses	6,10	1
Skills		
Interpret PET-CT	6	1
Provide expert opinion on appropriate patient imaging	6	1,2,3
Provide expert image interpretation	6	1,2,3
Be able to accurately report most cases	6	1,2,3
Write clear succinct reports which emphasise the key findings and diagnoses	6	1,2
<b>Intervention</b> –More challenging lung and mediastinal biopsy	7	1,2,3
<b>Intervention</b> – Radiofrequency ablation (optional)	7	1,2,3
Behaviour		
Be able to discuss complex cases with patients, referring clinicians and colleagues	6,7,8	1,2,3
Discuss with specialist centre appropriately	6	1,2,3
Highly organised work pattern	6,8	1,2,3
Swiftly prioritise cases according to clinical need	6,8	1,2,3
Rapidly establish clinical problem	6,8	1,2,3
Be able to succinctly relate clinical and imaging findings	6	1,2
Active role in service delivery	6	1,2
Assume a leadership role in multidisciplinary meetings	6,11	1,2,3
Team approach	6,8	2,3
Offer timely specialist opinion	6	1,2,3

**Table TD – Thoracic Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Infections of the lungs and pleura**

- Pneumonia
- Empyema
- Tuberculosis
- Lung abscess

**AIDs and other forms of immunocompromise**

- Fungal disease
- Other opportunistic infections

**Neoplasms of the lungs, airway, mediastinum and pleura**

- Lung cancer
- Lymphoma
- Mediastinal masses
- Malignant pleural mesothelioma
- Benign pulmonary lesions

**Pulmonary and aortic vascular diseases and pulmonary oedema**

- Aortic aneurysm
- Aortic dissections
- Cardiac failure
- Acute Pulmonary embolism
- Chronic Thromboembolic Pulmonary Hypertension
- Pulmonary arterial hypertension
- Pulmonary arteriovenous malformations
- Arteritis e.g. Takayasu's

**Inhalation lung diseases**

- Extrinsic allergic alveolitis/hypersensitivity pneumonitis
- Pneumoconiosis
- Emphysema
- Smoking related interstitial lung disease
- Aspiration

**Drug and Radiation-induced diseases of the lung**

**Immunologic diseases of the lung**

- Vasculitides
- Interstitial pneumonias

**Pulmonary diseases of unknown origin and miscellaneous pulmonary disorders**

- Sarcoidosis
- Langerhans' Cell Histiocytosis

## Diagnoses – Common/Uncommon (Level1/2)

- Lymphangiomyomatosis
- Pulmonary haemorrhage
- Pulmonary Alveolar Proteinosis
- Eosinophilic lung diseases

### **Congenital disorders of the lungs and airways**

- Anomalous pulmonary venous drainage
- Pulmonary Sequestrations
- Bronchial Tracheal Atresia
- Congenital cystic pulmonary lesions
- Lung agenesis and hypoplasia

### **Pleural disorders**

- Effusion
- Empyema
- Pneumothorax
- Haemothorax
- Malignancy
- Asbestos and non-asbestos-related benign pleural thickening
- Benign pleural tumours

### **Airway diseases**

- Bronchiectasis
- Allergic bronchopulmonary aspergillosis
- Foreign body
- Small airway diseases – constrictive obliterative and exudative bronchiolitis
- Tracheomalacia/tracheobronchomalacia
- Tracheal stenosis
- Asthma
- Chronic obstructive pulmonary disease

### **Trauma and intensive care**

- Lines, tubes and devices
- Pneumomediastinum/pneumothorax
- Aortic transection
- Diaphragmatic rupture
- A.R.D.S.
- Flail segment
- Bronchial rupture
- Lung contusion and laceration

### **Post operative thorax and complications**

- Wedge resection, lobectomy, pneumonectomy
- Lung transplantation

**Diagnoses – Common/Uncommon (Level1/2)**

- Aortic graft/stent
- Lung volume reduction surgery

## Uro-gynaecological Radiology

### Core Uro-gynaecological Training

To acquire basic clinical, pathological and radiological understanding of urogynaecological disease with reference to common presentations (Table UP)

Knowledge	Assessment Methods	GMP
Understand clinical significance of pathology associated with presentation and link with likely diagnoses	2,4,5,6	1
Know applied anatomy to interpret urogynaecological imaging	2,4,5,6	1
Understand role of radiology in the specific clinical setting	2,4,5,6	1
Know local/regional guidelines in relation to presentations	2,4,5,6	1
Skills		
Determine optimal imaging examination and know limitations of study	4,5,6	1
Plain x-ray interpretation	4,5,6	1
Perform and interpret imaging studies	6,7	1
Perform and report abdominal and pelvic ultrasound of common presentations	7	1
Interpret and report CT/MRI studies of common presentations	7	1
<b>Intervention</b> – see General and non-vascular intervention	7	1
Behaviour		
Apply/adhere to local/regional guidelines	7,8	1,2
Prioritise workload to respond to most urgent cases first	7,8	1,2,3
Communicate results rapidly	7,8	1,2,3
Involve seniors appropriately	8	1,2,3
Attend MDTs	8,11	1,2,3

**Table UP – Uro-gynaecological Radiology Presentations**

**Common Presentations (Core)**

- Haematuria
  - Macroscopic
  - Microscopic
- Loin pain
- Recurrent infection
- Anuria
- Renal failure (acute or chronic)
- Renovascular Hypertension
- Lower Urinary Tract Symptoms
- Dysuria
- Retention of urine
- Incontinence of urine
- Poor urinary flow
- Pelvic Mass
- Pelvic Pain
- Abdominal Pain
- Abdominal Mass
- Raised PSA
- Scrotal pain (acute and chronic)
- Scrotal Mass
- Dysmenorrhoea
- Infertility – male & female
- Vaginal Prolapse

### Level 1 Uro-gynaecological Training

To acquire detailed clinical, pathological and radiological understanding of urogynaecological disease with reference to presentations (Table UP) and common diagnoses (Table UD)

Knowledge	Assessment Methods	GMP
Recognise typical and variant presentations of common conditions	6,10	1
<b>Intervention</b> – see General and non-vascular intervention	7,10	1
Skills		
Require minimal supervision with most cases	6,7	1
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7	1,2
Recognise how diagnosis affects management pathway	6,7	1,2
<b>Intervention</b> – see General and non-vascular intervention	7	1
Behaviour		
Seek additional clinical information relevant to case	6,7	1,2
Tailor examination to clinical indication	6,7	1
Initiate additional examination as appropriate	6,7	1
Formulate appropriate DDx	6,7	1
Participate in MDTs	8,11	1,2,3
Take part in teaching and training	8,10	1

## Level 2 Uro-gynaecological Training

To acquire detailed clinical, pathological and radiological understanding of urogynaecological disease with reference to presentations (Table UP) and uncommon diagnoses (Table UD)

Knowledge	Assessment Methods	GMP
Detailed understanding of most clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant anatomy relevant to above	6,10	1
Recognition of uncommon conditions	6,10	1
Skills		
Provide expert advice on most appropriate patient imaging	6	1
Provide expert image interpretation	6	1
Be able accurately to report most cases	6	1
Write clear succinct reports which emphasise the key findings and diagnoses	6	1
<b>Intervention</b> – see General and non-vascular intervention	7	1
Behaviour		
Highly organised work pattern	8	1,2,3
Automatically prioritise cases according to clinical need	6,7,8	1,2,3
Discuss complex cases with referring clinicians and colleagues	6,7,8	1,3
Establish clinical problem quickly	6,7	1
Be able succinctly to relate clinical and imaging findings	6,7	1
Active role in service delivery	6,7,8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3
Discuss with specialist centre appropriately	7,8	1,2,3

**Table UD – Uro-gynaecological Radiology Diagnoses**

**Diagnoses – Common/Uncommon (Level1/2)**

**Kidney and Ureter**

- Congenital
- Obstruction
- Calculus
- Infection
- Tumours
- Cystic diseases
- Medical nephropathies
- Vascular
- Renal transplantation
- Trauma

**Bladder**

- Congenital
- Obstruction
- Inflammatory
- Tumours
- Trauma
- Incontinence & functional disorders
- Urinary diversion
- Neurological

**Retroperitoneum**

- Congenital
- Infection
- Trauma
- Tumours

**Urethra**

- Congenital
- Strictures
- Diverticula
- Trauma

**Prostate & Seminal Vesicles**

- Congenital
- Benign prostatic hyperplasia
- Inflammatory
- Tumours

**Penis and Scrotum**

- Congenital
- Inflammatory
- Torsion

## Diagnoses – Common/Uncommon (Level1/2)

- Tumours
- Penis - Impotence/Erectile dysfunction

### Adrenal

- Masses
- Incidental finding
- Abnormal biochemistry
- Functional disorders

### Uterus

- Congenital anomalies
- Tumours (benign and malignant)
  - myometrium
  - endometrium
  - cervix
- Inflammation
- Adenomyosis

### Ovaries / Fallopian Tubes

- Cysts (Physiological, polycystic)
- Tumours (benign and malignant)
- Functional disorders, e.g. precocious puberty, polycystic ovaries
- Endometriosis
- Inflammatory disorders

### Vagina

- Congenital abnormalities
- Benign and malignant tumours
- Pelvic floor dysfunction

## Vascular Radiology

### Core Vascular Training

To acquire basic clinical, pathological and radiological understanding of vascular disease with reference to common presentations (Table VP)

Knowledge	Assessment Methods	GMP
Understand clinical significance of pathology associated with presentation and link with likely diagnoses	2	1
Identify the role of vascular radiology in the specific clinical setting	2	1
Recall basic vascular anatomy in clinical practice relevant to imaging examinations of the: <ul style="list-style-type: none"> <li>• Gastrointestinal tract</li> <li>• Trauma</li> <li>• Peripheral vascular disease</li> <li>• Cerebrovascular disease</li> <li>• Cancer</li> <li>• Aorta</li> <li>• Dialysis access</li> <li>• Veins</li> </ul>	1,6	1
Local/regional guidelines in relation to vascular presentations	2,7	1,2
Skills		
Report plain radiographs relevant to CV disease showing awareness of limitations	4,5,6	1,2
Determine optimal imaging examination	4,5,6	1,2
Undertake basic assessment of the urgency of clinical situation	6	1,2,3
Construct imaging pathway in relation to management options for vascular pathologies	5,6	1,2,3
Performance/protocol of basic non invasive imaging; US, CT, MRI	7	1
Write provisional interpretation/report of imaging	6,7	1
<b>Intervention:</b> see core general and non-vascular intervention. No specific vascular skills	7	1
Behaviour		
Apply/adhere to local/regional guidelines	5,6,7	1,2
Prioritise workload to respond to most urgent cases first	5,6,7,8	1,2,3
Rapid communication of results	5,6,7,8	1,2,3
Appropriate involvement of seniors	5,6,7,8	1,2,3

**Table VP – Vascular Radiology Presentations**

**Common Presentations (Core)**

**Haemorrhage**

- GI – haematemesis, melaena
- Trauma
- Haemoptysis
- Vessel rupture
- Post partum

**Acute Ischaemia**

- Peripheral
- Cerebrovascular
- Pulmonary Embolic

**Chronic Ischaemia**

- Peripheral
- GI
- Renal

**Venous Occlusion**

- Deep venous thrombosis
- Superior Vena Cava Obstruction.
- Budd Chiari Syndrome

**Pulsatile Mass**

- Femoral false aneurysm
- Abdominal Aortic aneurysm

## Level 1 Vascular Training

To acquire detailed clinical, pathological and radiological understanding of vascular disease with reference to presentations (Table VP) and common diagnoses (Table VD).

Knowledge	Assessment Methods	GMP
Recall vascular anatomy of all organ systems and peripheral circulation	6,10	1
Recognise typical and variant presentations of common conditions	6,10	1
Familiarity with common acute and elective presentation of vascular pathologies in different organ systems and clinical scenarios	6,10	1
Recognise the clinical sequelae of the diagnoses of vascular conditions	6,10	1
Recognise the medical, interventional and surgical management options for vascular conditions	6,10	1
Skills		
Be able to accurately report most cases and emphasise the key findings and diagnoses	6,7	1
Participate in acute interventional rota	8	1,2,3
Organise and undertake appropriate imaging pathways in investigating vascular conditions	6,7	1,3
Recognise/seek constellations of appearances which advance diagnosis	6,7	1
Recognise clinical priority of certain presentations	6,7,8	1
Recognise how diagnosis affects management pathway	6,7	1
Perform clinical assessment of patients with vascular conditions in ward and out-patient settings	6,7	1,3
<b>Develop procedural skills in elective and acute cases</b>		
Ultrasound guided insertion of central lines	7	1
Perform diagnostic angiography	7	1
Perform angioplasty and stenting in various territories	7	1
Perform inferior Vena Caval Filter Insertion	7	1
Perform basic embolotherapy including embolotherapy required to control haemorrhage	7	1
Perform thrombin injection of false aneurysm	7	1
Retrieval of Intravascular Foreign Bodies	7	1
Able to deploy closure devices	7,	1,2,3
Demonstrates proficiency in cross-sectional vascular imaging interpretation	7,8	1,2,3
Develop proficiency in vascular ultrasound for: <ul style="list-style-type: none"> <li>• Peripheral vascular disease</li> <li>• Carotid arteries</li> <li>• Venous obstruction/thrombosis</li> <li>• Dialysis access</li> </ul>	7	1,2,3,4
Recognise and manage complications of vascular interventions	6,7,8	1,2

Behaviour	Assessment Method	GMP
Seek additional clinical information relevant to case	6,7	1,2,3
Tailor examination to clinical indication	6,7	1,2
Initiate additional examination/investigation as appropriate	6,7	1,2
Formulate appropriate DDx	6,7	1,2
Participate in MDTs	8,11	1,2,3
Enter performance data into local and national registries	9	1,2,3
Perform reflective learning from clinical practice, audit and registry data	6,9	1,2,3,4
Take part in teaching and training	8,10	1

## Level 2 Vascular Training

To acquire detailed clinical, pathological and radiological understanding of vascular disease with reference to uncommon presentations and diagnoses (Table VD)

Knowledge	Assessment Methods	GMP
Detailed understanding of clinical presentations and diagnoses	6,10	1
Detailed knowledge of normal and variant vascular anatomy relevant to above	6,10	1
Recognition of uncommon conditions	6,10	1
Understands and is able to advise on risk factor modification including diabetes	6,10	1
Skills		
Become competent in the clinical examination of the vascular patient	6,7	1
Provide expert advice on vascular foot care including the diabetic foot	6,7	1
Interpret laboratory data and non-invasive investigations eg APBI and exercise testing	6,7	1
Provide expert opinion on appropriate patient imaging	6,7	1,2,3
Provide expert image interpretation	6,7	1,2,3
Participate in acute interventional rota (where appropriate)	8	1,2,3
Organise and undertake appropriate imaging pathways in investigating vascular conditions	6,7	1,3
Independently run one stop clinics	7,8	1,2,3
Perform complex angioplasty and stenting e.g. renal, carotid, visceral and below the knee	7	1,2,3
Perform surgical exposure of arteries and veins	7	1,2,3
Perform super-selective embolisation/chemo-embolisation	7	1,2,3
Perform complex central line insertion	7	1,2,3
Perform TIPSS	7	1,2,3
Perform endovascular stent grafting e.g. EVAR, tEVAR	7	1,2,3
Perform renal denervation	7	1,2,3
Perform venous ablation and sclerotherapy	7	1,2,3
Recognise and manage complications of vascular interventions	6,7	1,2,3

Behaviour	Assessment Methods	GMP
Highly organised work pattern	8	1,2,3
Automatically prioritise cases according to clinical need	6,7,8	1,2,3
Discuss complex cases with referring clinicians and colleagues	6,7,8	1,2,3
Establishes clinical problem quickly	6,7	1
Be able succinctly to relate clinical and imaging findings	6,7	1
Show awareness of international relevant guidelines	6,7	1
Active role in service delivery	8	1,2,3
Assume a leadership role in multidisciplinary meetings	8,11	1,2,3
Offer timely specialist opinion	8	1,2,3
Discuss with specialist centre appropriately	7,8	1,2,3
Enter performance data into local and national registries	9	1,2,3

**Table VD – Vascular Radiology Diagnoses**

Diagnoses – Common/Uncommon (Level1/2)
<p><b>Arterial Disease</b></p> <ul style="list-style-type: none"> <li>• Peripheral arterial disease upper and lower limbs.</li> <li>• Thoracic aorta and upper extremity arterial disease.</li> <li>• Aneurysm: thoracic and abdominal.</li> <li>• Supra-aortic pathology, including carotid and vertebral.</li> <li>• Arteriovenous malformations.</li> <li>• Vascular trauma</li> <li>• Visceral arterial pathology: gastrointestinal bleeding, visceral aneurysm and ischaemia, renal, tumours, bronchial.</li> <li>• Arterial problems in obstetrics and gynaecology: fibroid embolisation.</li> <li>• Arterial pathology in cancer.</li> <li>• Management of hepatic malignancy (vascular)</li> <li>• Syndromes with a major vascular component</li> </ul> <p><b>Venous Disease</b></p> <ul style="list-style-type: none"> <li>• Venous diagnosis and intervention.</li> <li>• Peripheral venous disease inc Peripheral deep venous thrombosis</li> <li>• Pulmonary thrombo-embolic disease</li> <li>• Superior and inferior vena cava Disease</li> <li>• Hepatic venous disease</li> <li>• Portal venous disease including portal hypertension</li> <li>• Gynaecological venous intervention</li> <li>• Haemodialysis access</li> <li>• Central Venous Access</li> </ul>

## Academic Radiology

A number of trainees may embark on a combined clinical and academic training programme. These trainees are academic clinical fellows (ACF) and academic clinical lecturers (ACL). The ACF is the year 1-3 trainee who has not usually completed a higher degree. The ACL is usually a year 4-5 trainee who will have completed a higher degree (PhD or MD). The ACF is a 75%/25% clinical /academic split and the ACL is 50%/50% clinical /academic split. These training positions promote research and allow trainees to complete competences set out within the general syllabus as well as those illustrated below. Assessment for these competences is limited within the current methods, but evidence can be sought from the academic activity undertaken by the trainee and from their involvement in research outputs/registries.

It is generally expected that ACFs will take 2-3 year out of programme and OOP(R) and that they will obtain funding to undertake a higher degree by the end of year 3 at the latest. ACFs who are not successful in obtaining funding to pursue a higher degree will return to normal radiology training following core academic training.

## Core Academic training

To acquire basic competencies in teaching and research appropriate to a trainee in Academic Radiology  
To concurrently pursue core training in radiology specific and generic specific aspects of the Radiology Curriculum

Knowledge	Assessment Methods	GMP
Understand process of grant application		1
Understand research governance		1,2
Familiarity with research methods appropriate to area of interest.		1
Familiarity with current literature, especially in areas of own interest		1
Skills		
Basic research skills including statistics and GCP training		1,2
Contribute to the writing of grant applications		1,2
Contribute to completion of applications to Research Ethics Committees (REC), Research and Development Department, MHRA etc.		1,2
Contribute to the formation and execution of audit and research projects	9	1,2
Developing skills in management and leadership	8	1,2
Develop presentation and teaching skills	10	3
Formally participate in the running of a local teaching programme		1,3
Literature search techniques		1,2
Behaviour		
Participate fully in clinical audit and research	9	1,2
Attend relevant educational meetings		1,2
Interact with relevant research scientists	8	3
Access and develop the learning materials		1,2
Contribute to the teaching programme of the training centre	10	1,2,3
Present research and audit at national and international meetings	10	1
Publish in appropriate journals		1

## Level 1 Academic Training

Acquire increasing competencies in teaching and research appropriate to a trainee in Academic Radiology		
Knowledge	Assessment Methods	GMP
Detailed knowledge of undertaking a major research project		1,2,3
Maintain familiarity with the literature and searching techniques		1
Maintain and develop knowledge of relevant methodology including epidemiology and statistics		1
Skills		
Write own grant application		1,2,3
Prepare and present application to REC etc		1,2
Participate in management and leadership of research project		1,2,3
Help to run local teaching programme	10	1,2,3
Present regularly at national and international meetings	10	1,2,3
Active role in audit	9	1,2,3
Be able to perform a detailed literature search		1
Maintain and develop relevant radiology expertise	6,7	1
Behaviour		
Develop confidence as a research supervisor		1,2,3
Take part in teaching and training	8,10	1

## Level 2 Academic Training

Acquire full competencies in teaching and research		
Knowledge	Assessment Methods	GMP
Know how to plan and execute research projects independently		1,2,3
Know how to organise and manage a teaching programme	10	1,2,3
Skills		
Be able to perform complex literature searches		1
Maintain and develop relevant radiology expertise		1
Help to organise and manage a teaching programme	10	1,2,3
Plan and execute research projects independently		1,2,3
Assume a lead role in audit	9	1,2,3
Behaviour		
Provide appropriate research supervision of other healthcare professionals		1,2,3
Full competence as a research supervisor		1,2,3

### **3 SUPPORT FOR LEARNING, SUPERVISION AND FEEDBACK**

#### **The Model of Learning**

Trainees will achieve the competences described in the curriculum through a variety of learning methods. There will be a balance of different modes of learning, from formal teaching programmes to experiential learning 'on the job'. The proportion of time allocated to different learning methods may vary depending on the nature of the attachment within a rotation.

There must be robust arrangements for quality assurance in place to ensure consistent implementation of the curriculum.

#### **Work-based Experiential Learning**

The content of work-based experiential learning is decided by the local faculty but includes active participation in:

- Radiological attachments with gradual reduction in supervision according to increasing competence as judged by trainers (apprenticeship model). A major component of training in clinical radiology is achieved by the apprenticeship system with the trainee undertaking an increasing number of radiological tasks.
- Multidisciplinary team meetings: These inter-disciplinary meetings provide excellent learning opportunities.
- On-call and emergency provision.

The degree of responsibility taken by the trainee will increase as competency increases. There should be appropriate levels of supervision throughout training with increasing independence and responsibility as learning outcomes are achieved.

#### **Optional Work-based Experiential Learning**

Time spent within clinical teams related to special interest area to more fully understand clinical aspects of their work either as a clinical attachment or paired with appropriate trainee clinician to engage in co-learning, as agreed with clinical supervisors.

#### **Formal Postgraduate Teaching**

- A programme of formal, regular teaching sessions to cohorts of trainees
- Case presentations
- Journal clubs
- Research and audit projects
- Lectures and small group teaching
- Grand Rounds
- Radiological skills demonstrations and teaching
- Joint meetings with clinical specialties
- Attendance at training programmes organised on a school or regional basis, which are designed to cover aspects of the training programme outlined in this curriculum

### **Independent Self-Directed Learning**

Trainees will use this time in a variety of ways depending upon their stage of learning. Suggested activities include

- Preparation for assessment and examinations
- Reading, including web-based material
- Maintenance of personal portfolio (self-assessment, reflective learning, personal development plan)
- Audit, quality improvement and research projects
- Reading journals
- Achieving personal learning goals beyond normal expectation

### **Formal Study Courses**

Time to be made available for formal courses is encouraged, subject to local conditions of service. Examples include management courses and communication courses.

### **Learning Experiences**

Clinical and educational supervisors will be encouraged to identify learner centred educational opportunities in the course of clinical work. Radiology trainees and their teachers will recognise the importance of maximising the wide variety of learning opportunities in the clinical radiological workplace.

- *Learning from Practice:* Trainees will spend a large proportion of work-based experiential learning involved in supervised radiological practice in a hospital setting. Learning will involve closely supervised practice until competencies are achieved. The learning environment will be in all areas of the imaging department and in other areas where imaging services are provided (eg bedside ultrasound)
- *Learning with Peers:* There are many opportunities for trainees to learn with their peers. Local postgraduate teaching opportunities allow trainees of varied levels of experience to come together for small group sessions. Examination preparation encourages the formation of self-help groups and learning sets.
- *Learning in Formal Situations:* There are many opportunities for formal teaching in the local postgraduate teaching sessions and at regional, national and international meetings.
- *Personal Study:* Time will be provided during training for personal study. It may be possible for longer periods of private study to be offered as part of study leave.
- *Specific Teacher Inputs:* Individual units within a teaching programme will identify where specific teacher inputs will be provided. These will vary from programme to programme. Examples include
  - Each trainee having a radiological supervisor for each attachment for work-based experiential teaching
  - Special interest teaching in a radiological environment from a recognised specialist
  - Structured teaching sessions

### **Supervising and supporting workplace-based learning**

Educators need to identify their own professional development needs in order to carry out their role effectively, and develop the confidence and expertise to support workplace learning.

The roles of the educators needed to support learning activities include adviser, appraiser, assessor, clinical supervisor, coach, co-learner, critical friend, educational supervisor, expert, facilitator, mentor, teacher, trainer and tutor.

### **Requirement for Trainers**

The GMC has published plans for implementing new arrangements for the formal recognition of trainers, with local systems to be in place by July 2013 and all trainers in the roles of educational supervisor and clinical supervisor to be fully recognised by July 2016. Resources to support trainees and trainers can be found on the RCR website.

All trainers are expected to:

- have demonstrated an interest in and developed a knowledge of training
- have appropriate equipment available
- have a sufficiently large spectrum of cases to ensure curriculum coverage
- have appropriate teaching resources
- be up-to-date with the requirements of the RCR continuing professional development scheme and be in possession of appropriate supporting documents
- have substantial expertise and knowledge in their area(s) of clinical practice

When learning in and from practice, it is important to understand that the roles of trainers may overlap and differ in subtle ways. In these cases supervision provides essential support. However:

- the needs of the learner should determine which role is adopted, and these change over time and in different situations
- skilled educators move in and among these roles according to identified need
- enough time should be allocated to develop these roles and relationships
- those involved should aspire to mutually negotiated and fair outcomes, but they should also recognise that supervision involves a power relationship
- good educational practice requires a balance of the following aspects:
  - support
  - challenge
  - clarification of the standards to be achieved
  - clarification of the consequences of non-achievement

## **Educational supervisor**

All radiology trainees will have an educational supervisor.

An educational supervisor is appropriately trained to be responsible for the overall supervision and management of a specified trainee's educational progress during a training placement or series of placements. The educational supervisor is integral to the appraisal process. A trainee appraisal with the educational supervisor will include feedback on performance, review of outcomes of assessments, induction to posts and career advice. The postgraduate deaneries should recognise the active role of educational supervisor in training and offer appropriate support.

Local education providers must ensure that educational supervisors have adequate support and resources to undertake their training role. This will include training in equality and diversity.

The educational supervisor (ES) will

- ensure that the programme is appropriate for the doctor's needs
- be responsible for the radiology trainee's educational agreement
- meet with the radiology trainee at the beginning of each placement to agree how the learning objectives for this period of training will be met and confirm how formative feedback and summative judgements will be made.
- help radiology trainees by reviewing their learning needs in the light of achieved goals
- collate and/or carry out assessments from clinical supervisors, trainers and other assessors
- review the radiology trainee's learning ePortfolio
- conduct appraisals and give supportive feedback on the results of MSF
- complete the structured supervisor's report at the end of each year of training prior to the ARCP.
- support the trainee through any difficulty
- tell the clinical director, head of service or medical director and those responsible for training, of serious weaknesses in their trainee's performance that have not been dealt with.
- tell the radiology trainee the content of any information about them that is given to someone else
- ensure that all training opportunities meet the requirements of equality and diversity legislation
- give appropriate handover to the next educational supervisor, with the radiology trainee's knowledge.

The educational supervisor, when meeting with the trainee, should discuss issues of clinical governance, risk management and the report of any untoward clinical incidents involving the trainee. The educational supervisor is part of the clinical speciality team. Thus, if the clinical directorate (clinical director) should have any concerns about the performance of the trainee, or there were issues of doctor or patient safety, these would be discussed with the educational supervisor. These processes, which are integral to trainee development, must not detract from the

statutory duty of the Employer to deliver effective clinical governance through its management systems.

### **Clinical supervisor**

A trainer is selected and appropriately trained to be responsible for overseeing a specified radiology trainee's education and clinical work, and providing constructive feedback during a training placement. Some training programmes appoint an educational supervisor for each placement. The roles of clinical and educational supervisor may then be merged.

A clinical supervisor will usually be the consultant to whom a radiology trainee is directly responsible for their clinical work. There will be frequent contact between them. The educational supervisor may see the radiology trainee much less often.

Local education providers must ensure that clinical supervisors have adequate support and resources to undertake their training role. This will include training in equality and diversity.

The clinical supervisor is responsible for

- ensuring that their radiology trainees are never put in a situation where they are asked to work beyond their competence without appropriate support and supervision. Patient safety must be paramount at all times.
- guaranteeing suitable induction to the radiology department
- meeting with the radiology trainee at the beginning of each placement to discuss what is expected in the placement, learning opportunities available and the trainee's learning needs
- ensuring that the clinical experience available to the trainee is appropriate and properly supervised
- ensuring that all training opportunities meet the requirements of equality and diversity legislation
- monitoring, supporting and assessing the radiology trainee's day-to-day clinical and professional work
- providing regular feedback on the trainee's performance
- undertaking and facilitating WpBA
- allowing the trainee to give feedback on the experience, quality of training and supervision provided
- discussing serious concerns with the educational supervisor about a trainee's performance, health or conduct
- meet with the radiology trainee to assess whether they have met the necessary outcomes and complete an end of placement review form for each placement

The first year in clinical radiology can be a difficult year of transition for trainees. Training programme directors (TPDs) and College tutors are encouraged to offer advice, a mentor system and a counselling service during the year. The following milestones should be acknowledged:

The trainee should meet with their Educational Supervisor (ES), the College tutor (CT) in the hospital where they are working and their TPD at the start of their

appointment, and again after three months in it. Some individuals may undertake more than one of these roles simultaneously.

The trainee's practice must be closely supervised and patient safety is of paramount importance. Such aspects are monitored by the clinical supervisor for each individual rotation and documented in the formal ePortfolio. Formal mechanisms for feeding back any concerns raised by the clinical supervisor, to the trainee, and the ES, CT and TPD, should be in place. There should be a formal mechanism for counselling trainees who are unsuccessful in the First FRCR Examination.

All training in postgraduate radiology should be conducted in institutions with appropriate standards of clinical governance and that meet relevant Health and Safety standards for clinical areas. Training placements must also comply with the European Working Time Directive for trainee doctors.

Trainees must work with a level of clinical supervision commensurate with their clinical experience and level of competence. This is the responsibility of the relevant clinical supervisor after discussion with the trainee's educational supervisor and the designated clinical governance lead. In keeping with the principles of Good Medical Practice, trainees should know that they must limit their clinical practice to within their level of clinical competence and seek help and support without hesitation.

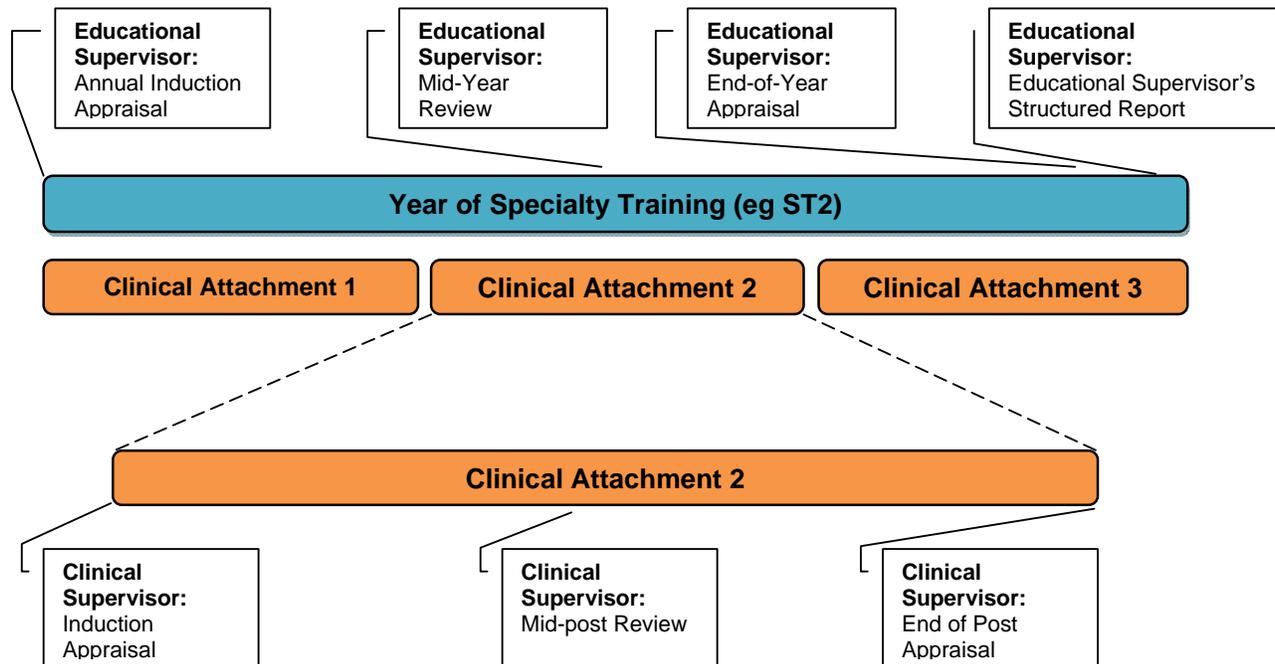
### **Feedback**

Frequent and timely feedback on performance is essential for successful work-based experiential learning. To train as a radiologist, a doctor must develop the ability to seek and respond to feedback on clinical practice from a range of individuals to meet the requirements of Good Medical Practice and revalidation.

Constructive feedback should be provided throughout training in both formal and informal settings. Opportunities for feedback will arise during appraisal meetings, when trainees are undergoing workplace-based assessments, in the workplace setting, and through discussions with supervisors, trainers, assessors and those within the team.

## 4 APPRAISAL

A formal process of appraisals and reviews underpins training. This process ensures adequate supervision during training, provides continuity between posts and different supervisors and is one of the main ways of providing feedback to trainees. A “typical” year of appraisals involving both clinical and educational supervisors is illustrated below (Diagram 1). All appraisals should be recorded in the ePortfolio.



**Diagram 1:** Appraisal Meetings during a Single Academic Year in Training

### Annual Induction Appraisal

When radiology trainees start in a new training year, they must arrange a meeting with their educational supervisor. This is primarily the responsibility of the radiology trainee. An educational agreement is signed between the educational supervisor and trainee is an essential starting point for negotiating the educational goals and discussing learning opportunities, the assessment process and use of the ePortfolio. Overarching educational aims for the year ahead should be agreed within the personal development plan.

### Clinical Supervisor: Induction Appraisal

When radiology trainees start in a new placement, they must arrange a meeting with their clinical supervisor (this role may be discharged in some cases by the educational supervisor). These arrangements are primarily the responsibility of the radiology trainee. The appraisal discussions should cover the educational objectives for the clinical attachment and be used to inform the personal development plan (PDP).

### **Clinical Supervisor: Mid-Post Appraisal**

A mid-point meeting during a clinical attachment, although not mandatory is highly recommended. It gives the trainee and clinical supervisor the opportunity to look at the achievements of the trainee and highlights areas for future development, in terms of the PDP and curriculum competences.

### **Clinical Supervisor: End of Post Appraisal**

Towards the end of a placement, the radiology trainee and clinical supervisor will meet again for an appraisal. They will need to review the ePortfolio, the PDP and the results of assessments made during the placement. This process will involve review of colleagues' comments, who have observed the doctor's performance in practice and/or in individual assessments. If the educational supervisor is different from the clinical supervisor, there should be a robust communication system to ensure a continuous, appropriate, and timely flow of evidence. This should include a 'supervisor's report sign off' document confirming satisfactory performance and progress. It should detail any outstanding issues that still need to be addressed.

### **Educational Supervisor's Mid-Year Appraisal**

A mid-year appraisal with the educational supervisor is an opportunity to look at the trainee's progress against the agreed educational objectives within the ePortfolio. It is at/around this meeting that the MSF is undertaken.

### **Feedback and debriefing**

Feedback is a key component of the interactions between supervisors and radiology trainees. Giving and receiving feedback and engaging in constructive conversations about learning, successes, difficulties and progress are all part of an effective professional learning environment. Improvement in clinical radiological practice will only happen if regular review leads to constructive feedback. Unscheduled assessments are a good opportunity for immediate feedback. This is particularly true of Rad-DOPS and Mini-IPX, which may be opportunistic. It is essential that trainers provide, and radiology trainees receive, structured feedback.

### **Log Book**

Logbooks should be used for documenting the skills and experience attained and to facilitate reflective learning. Logbooks are mandatory for all interventional procedures irrespective of special interest.

The training objectives identified in this curriculum document (encompassing knowledge, skills and behaviours) are mapped with the appropriate assessment tools, which can be used to illustrate proof of learning across the curriculum. All these methods and tools are included in the ePortfolio.

These training objectives are used to assist trainee appraisal and assessment during specialty training and when achieved can verify that training has taken place to the required standard for a Certificate of Completion of Training (CCT) to be awarded.

**ePortfolio**

The ePortfolio is the record for documenting assessments and other achievements. It is essential that radiology trainees populate the ePortfolio as it will be used to inform the end of year report by the education supervisor.

WpBA should be used to sample the trainee's performance. The syllabus section of the ePortfolio allows trainees to link WpBAs to individual curriculum competencies. It is not necessary for the trainee to have a WpBA or other evidence linked to every learning outcome. Providing the trainee demonstrates the relevant competencies during a clinical attachment and the clinical supervisor is satisfied that the competencies have been achieved, the trainee may successfully progress at ARCP.

**End of Training Year Appraisal**

The results of educational activities for an academic year will be drawn together and included in a formal structured educational supervisor's report. This will cover the overall performance of the trainee in each placement. The overall judgment of a trainee will include a triangulated view of the doctor's performance, which will include their participation in educational activities, appraisals, the assessment process and recording of this in the ePortfolio.

The outcome of the final appraisal discussion should be agreed by both the radiology trainee and the educational supervisor and recorded in the trainee's ePortfolio in the structured supervisor's report.

Placement reports put together in an annual structured educational supervisor's report will form the basis of the education supervisor's recommendations of satisfactory completion of the year of training.

## 5 ASSESSMENT

### Purpose of assessment

The assessment system included in this curriculum is intended to

- enhance learning by providing formative assessment, enabling trainees to receive immediate feedback, measure their own performance and identify areas for development;
- drive learning and enhance the training process by making it clear what is required of trainees and motivating them to ensure they receive suitable training and experience;
- provide robust, summative evidence that trainees are meeting the curriculum standards during the training programme;
- ensure trainees are acquiring competencies within the domains of Good Medical Practice;
- assess trainees' actual performance in the workplace;
- ensure that trainees possess the essential underlying knowledge required for Clinical Radiology;
- inform the Annual Review of Competence Progression (ARCP) is the culminating part of the assessment system;
- identify trainees who should be advised to consider changes of career direction.

### Assessment methodology

#### **Continuous assessment**

Improvement in clinical practice will only happen if regular review leads to constructive feedback. Thus, continuous review and assessment is a fundamental part of clinical radiology training. Radiology trainees are expected to demonstrate improvement and progression during each attachment. It is anticipated that radiology trainees will increasingly reach higher levels of attainments as they progress through their training. It is important that they arrange and undertake assessments in a timely and educationally appropriate manner spread throughout the year.

Arriving at the overall assessment and judgement of the radiology trainee must be based on multiple assessments by many assessors, on multiple occasions. During core training, within a typical three/four month placement, an individual consultant/assessor is unlikely to build up a coherent picture of competences, let alone performance, of an individual trainee. Therefore, the training programme director (TPD) will ensure that there is a local faculty of trainers capable of building a balanced judgement of a trainee's performance supported by the workplace based assessment results. Such an approach will prevent any individual having undue influence regarding a trainee's progression.

### **Self Assessment**

Radiology trainees have a personal responsibility to undertake self assessment an integral part of their professional life. It is good educational practice for this to be stated clearly and discussed fully during induction.

### **Assessment System and Tools**

Radiological practice will be assessed using an integrated package of workplace based assessments and summative examination of knowledge and radiological skills, which will sample across the domains of the curriculum. The assessment methods are fit for purpose and mapped onto the curriculum in an integrated way. The assessments will generate structured feedback for trainees within core radiological training and level1/2 training. The assessment tools have been selected on the basis of their fitness for purpose.

### **Summative Assessment**

The First FRCR Examination (Scientific Basis of Imaging module) and Final FRCR Part A Examination test knowledge through multiple choice and single best answer (SBA) questions. The First FRCR Examination (Anatomy module) tests knowledge by requiring the identification of normal anatomical structures on images. The Final FRCR Part B Examination assesses clinical competence (interpretative, analytical and communication skills)

### **Formative Assessment**

Workplace based assessment will be the cornerstone of assessment for day-to-day practice. There is a range of tools available for this use. These have undergone or are undergoing evaluation in terms of their feasibility, reliability, validity and reproducibility. The generic and radiologically specific workplace based assessment tools are

#### **A. Multisource Feedback**

- The multisource feedback (MSF) tool assesses generic skills across the domains of Good Medical Practice. It consists of the collated views from a range of co-workers (previously described as 360° assessment). It will be mapped to a self assessment tool with identical domains
- MSF should usually take place once a year, although the educational supervisor may choose to recommend an additional MSF to investigate a relevant behavioural issue or check progress after an adverse MSF.
- For each assessment, the radiology trainee should nominate 15 raters. A minimum of 12 returns are required.
- Most raters/assessors should be supervising consultants, doctors in training more senior than the trainee under assessment and experienced radiographic, nursing or allied health professional colleagues.

The recommended mix of raters/assessors is

- 2–4 senior doctors
- 2–4 doctors in training
- 2–4 radiographers
- 2–4 nurses/allied health professionals
- 2–4 other team members including clerks, secretaries and auxiliary staff

## B. Direct observation of doctor/patient encounter

Three tools can be used to assess radiologist/patient encounters:

- Mini-imaging interpretation exercise (Mini-IPX)
- Radiology- Direct observation of procedural skills (Rad-DOPS)

Radiology trainees are required to undertake a minimum of twelve observed encounters in each year of training although it is anticipated that they may/will undertake many more, as the WpBA are the vehicles by which the trainee will guarantee one-to-one teaching and ensure appropriate curriculum coverage during their clinical attachments.

### *Mini-imaging interpretation exercise (Mini-IPX)*

This is a structured assessment of an observed radiology interpretation/reporting episode:

- trainees should complete a minimum of six mini-IPX in each year of training. These should be spaced out during the year with at least two mini-IPX completed in each four month period.
- a different assessor should be used for each mini-IPX wherever possible, including at least one of consultant level, per four month placement
- assessors **must** be trained in giving feedback and understand the role of assessment.
- mini-IPXs should sample across different clinical radiological problems from the radiology specific content (categories listed in the *Syllabus and Competences* section)
- trainees should agree the timing, problem and assessor.
- assessors may also carry out unscheduled assessments.

### *Radiology-Direct observation of procedural skills (Rad-DOPS)*

This is a structured checklist for assessing the radiology trainee's interaction with the patient when performing a practical procedure:

- trainees must submit a minimum of six Rad-DOPS per annum
- different assessors should be used for each encounter wherever possible
- assessors must be trained both in the procedure and feedback methodology. They could include consultants, more senior doctors in training, advanced practitioner radiographers, qualified nurses or allied health professionals
- Rad-DOPS should sample a wide range of different procedures/skills
- trainees should choose timing, procedure and observer/assessor

- assessors may also carry out unscheduled assessments.

### **C. Teaching Observation**

- The Teaching Observation tool evaluates the competence of a trainee to deliver a teaching episode in a wide variety of settings.
- The Teaching Observation form is designed to provide structured, formative feedback to trainees on their competence at teaching.
- The Teaching Observation can be based on any instance of formalised teaching by the trainee, which has been observed by the assessor. The process should be trainee-led (identifying appropriate teaching sessions and assessors).

### **D. Audit Assessment and Quality Improvement**

The Audit Assessment tool is designed to assess a trainee's competence in completing an audit. The assessment can be based on review of audit or quality improvement documentation or on a presentation of the audit at a meeting. If possible, the trainee should be assessed on the same audit by more than one assessor.

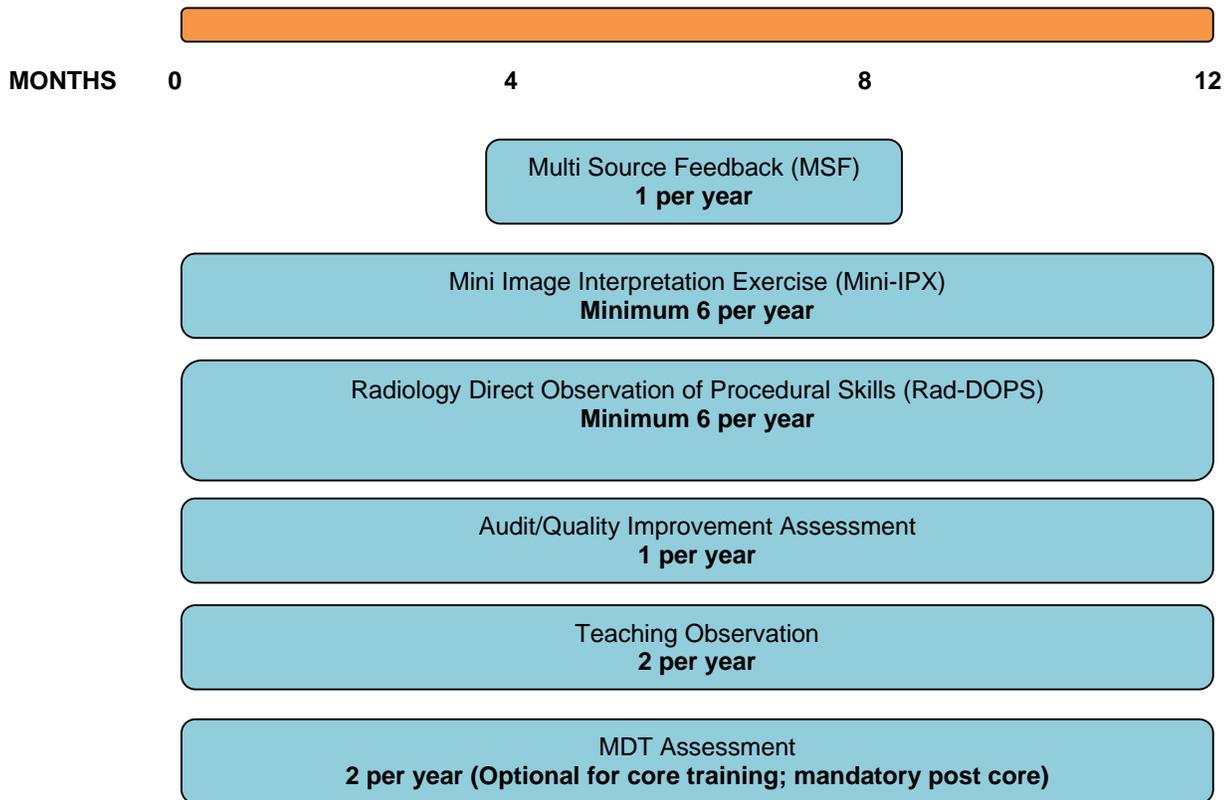
All trainees are expected to complete an audit or quality improvement project each year within the training programme. Trainees should show how they have instigated, collated and presented a piece of work, as well as reflected upon any changes in clinical management as a result of work completed.

### **E. MDT Assessment (MDTA)**

The MDT Assessment Tool is designed to provide feedback on a trainee's ability to contribute effectively to multidisciplinary team working and to assume a leadership role in multidisciplinary meetings. As with other workplace-based assessments it is based on the assessor observing a trainee and providing feedback. The assessments should be seen as opportunities for identifying strengths and areas for further development – they are not tests that must be passed.

MDTAs are optional for trainees in core training; they are mandatory for those in higher training (Years 4-6).

Figure 1. Assessment during a Year of the Clinical Radiology Training Programme



## 6 ANNUAL REVIEW OF COMPETENCY PROGRESSION (ARCP)

Individual progress will be monitored by an annual review, the (ARCP). It facilitates decisions regarding progression through the training programme, as well as identifying any requirements for targeted or additional training where necessary. The RCR recommends that the postgraduate dean should collaborate with the training programme director (TPD) and the regional postgraduate education adviser (REA) when overseeing these reviews. College tutors should also be involved in the process. The College offers every deanery the services of an external REA to provide “externality” to the ARCP process.

### ARCP Decision Aid

The following decision aid offers **guidance** on the domains to be reviewed and level of attainments suggested to inform an ARCP panel.

### Standards for Satisfactory Progression

	ST1	ST2	ST3	ST4	ST5
Curriculum coverage: Generic	20-30% focus area content at core level descriptor	50% focus area content at core level descriptor	Competent in all focus area content at core level descriptor	50% focus areas content by end of specialty training descriptor	Competent in all focus area content by end of specialty training descriptor
Curriculum coverage: Radiology Specific	20-30% common presentations at core level descriptor	60% common presentations at core level descriptor	90% common presentations at core level descriptor	Maintain core competence. Complete common presentations L1 Special interest area(s)	Maintain core competence. L2 Special interest area/multiple L1 interest areas
Indicative Workplace based Assessments/yr	6 mini-IPX (minimum 2 per clinical attachment), 6 Rad-DOPS (minimum 2 per clinical attachment), 1 MSF, 1 Audit Assessment/Quality Improvement Project, 2 Teaching Observations. MDTAs are optional in ST1-3; a minimum of 2 MDTAs per year is mandatory post-core training. WpBA should be undertaken in a timely and educationally appropriate manner <b>throughout</b> the training year. Progression predicated by satisfactory anchor statements				
		2 MDTAs	2 MDTAs	2 MDTAs	2 MDTAs
Examinations	First FRCR Examination	Final FRCR Part A Examination: three modules	Final FRCR Part A Examination: all six modules	Final FRCR Part B Examination	--
Research	One research project (actual or theoretical) undertaken during training and discussed with educational supervisor – see paragraph 1.8				
Education Supervisor's Structured Report	All areas of personal and professional development addressed with overall progress at expectation or above.				

The main possible outcomes of this assessment and the ARCP process are listed below:

- **Progress** into the next year of training. Indicative of satisfactory progression across all domains within the decision aid.
- **Unsatisfactory progression** will be informed by some or all of the following (the decision being undertaken by the ARCP panel): lack of curriculum coverage, inadequate or poor outcomes in workplace based assessments and/or examinations and areas of concern within the structures supervisor's report. This will result in one of two outcomes.
  - **Conditional progress** into the next year of training. A specific action plan will be formulated with the trainee to redress deficiencies in performance. Progress will be re-assessed as appropriate within the next year of training.
  - **Directed training without progression.** If the trainee is so far short of the objectives for their year of training such as to prevent them continuing into the next year of training, directed training is recommended to achieve those objectives. The RCR recommends that repetition of the entire year should only be recommended for exceptional reasons.

### **Appeals**

There are formal mechanisms for appealing against decisions taken at all stages of training. Appeals against decisions of the Deanery Specialty Training Committee are conducted locally under the supervision of the Postgraduate Dean. Appeals related to examination results are conducted by the RCR; information can be obtained from the Examinations section of the College's website. Appeals against a failure to award a CCT may be made to the GMC. It is important to be aware that the relevant regulations specify strict time limits within which appeals must be lodged.

## APPENDICES

### **APPENDIX A: CURRICULUM IMPLEMENTATION AND MANAGEMENT**

Summary of the management of curriculum implementation:

- The new curriculum has already been discussed with all Regional Postgraduate Education Advisers and Training Programme Directors, who meet twice yearly at the Royal College of Radiologists.
- Local training programmes will develop rotations that deliver the curriculum, which is checked by:
  - Regional Postgraduate Education Advisers at the workplace and through the Deanery led ARCP process
  - The training accreditation process supervised by local Deaneries and the GMC with input from the RCR

#### **Local Curriculum Management**

The organisation of training programmes for core radiological training and special interest training is the responsibility of Postgraduate Deaneries and their Schools of Radiology or equivalents.

The Deaneries have established appropriate programmes for postgraduate radiological training in their regions. In England and Northern Ireland, Deanery Schools of Radiology have been set up to achieve this. As the term "School of Radiology" is not applicable to all countries and regions, in this curriculum, the general term "local faculties for radiological training" will be used. There may be more than one training programme within a local faculty for radiological training. Each of these is managed by a Training Programme Director (TPD) who is accountable to the Deanery Head of School (or their equivalent). Within each participating local education provider (hospital) within a training scheme there is a College tutor who supports the delivery of training and the curriculum within that hospital and is accountable for this to the TPD. The deaneries, through their local faculties and training programmes, will together with the TPDs and college tutors co-ordinate local postgraduate radiological training, with terms of reference as follows:

- Allocate trainees into particular rotations for core radiological training, and then at ST4 and ST5 levels into rotations appropriate to their special interest training needs where possible.
- Oversee the quality of training posts provided locally.
- Interface with other Deanery Specialty Training faculties (General Practice, Anaesthesia etc).
- Ensure adequate provision of appropriate educational events.
- Ensure curricula implementation across training programmes.
- Oversee the workplace-based assessment process and programmes.
- Co-ordinate the ARCP process for trainees.
- Provide adequate and appropriate career advice.
- Provide systems to identify and assist trainee radiologists with training difficulties.

- Provide flexible training.
- Ensure the appropriate provision of potential to progress into an academic career

### **Intended Use of Curriculum by Trainers and Trainees**

The curriculum is freely available to trainees and trainer on the RCR and GMC websites. Each trainee will engage with the curriculum by maintaining a portfolio. The trainee will use the curriculum to develop learning objectives, self-assess accomplishments in disparate areas of the curriculum, and reflect on learning experiences.

### **ePortfolio**

The ePortfolio is a record of a trainee's progress and development through radiology training. It will provide a record of objective evidence of competence to work in a range of clinical settings and a record of satisfactory performance. This means that ePortfolio completion will contribute to the end of year report, annual review of competence progression (ARCP) and may also be used in interviews. Successful completion of the curriculum requires the achievement of competence in a variety of domains relating to generic medical practice, radiological and clinical practice. The assessments of these competences will be recorded in the ePortfolio.

### **Ensuring Curriculum Coverage**

The details of how the curriculum is covered in any individual training programme and training unit is the responsibility of the local faculty in consultation with the Royal College of Radiologists. The need to show how trainees are progressing in their attainment of competencies will be a strong driver in ensuring that all the curriculum objectives are met.

### **Curriculum Management**

Local management of the curriculum is the responsibility of the local faculty of education.

Coordination of the curriculum at a national and regional level is the joint responsibility of the Deaneries and the Royal College of Radiologists, with robust arrangements for quality assurance of training.

## **APPENDIX B: CURRICULUM DEVELOPMENT AND REVIEW**

The curriculum was revised and updated in 2013 by the Clinical Radiology Curriculum Committee of the RCR, reporting to the Specialty Training Board. The Curriculum Committee consulted with Special Interest Group Leads, the FRCR Physics and Anatomy Committees and the Specialty Training Board

The Specialty Training Board of the Faculty of Clinical Radiology of the Royal College of Radiologists is responsible for review of the curriculum. Formal review will take place every two years. Clinical radiology, as a technology supported specialty, is a rapidly changing and evolving specialty. The curriculum needs to be able to respond appropriately to these changes to ensure that radiology training and education reflect modern practice. The regular meetings of Special Interest Groups, the Curriculum Committee, the Professional Support and Standards Board and the Specialty Training Board allow opportunities for the curriculum to be discussed and amendments to be proposed and considered in advance of formal review.

Curriculum evaluation should establish how trainees have responded to the curriculum and that the curriculum facilitates practical delivery of the required training. The curriculum will be evaluated by means of a range of qualitative and quantitative data.

Trainees and lay representatives have been involved in the preparation of this curriculum and will continue to be involved in reviews, through representation from the Faculty's Junior Radiologists' Forum and the Patient Liaison Group. Trainers, tutors, Regional Advisers and Programme Directors will also continue to be involved in reviews through their membership of relevant working parties and committees.

### **Curriculum evaluation and monitoring**

#### *Evaluation of Training*

The curriculum is an educational guide, which will be interpreted and shaped locally. Evaluation is an essential element of the curriculum for monitoring and developing local implementation. Training programmes will vary in the extent to which they currently evaluate teaching, learning and supervision. Changes in the specialty training curriculum offer new opportunities for evaluation. Whilst there are GMC surveys of trainees and trainers that provide insights into the performance of training programmes, an evaluation process is a more forensic and locally relevant enquiry than can be achieved through a national questionnaire. Local evaluation will provide the evidence for training programme development, as well as material with which to respond to the findings of the annual GMC survey. The Faculty of Clinical Radiology is not intending to conduct local evaluation at the present time. It is, therefore, the responsibilities of individual training programmes to carry out this necessary work. The sections below are intended as a guide.

#### *Who is involved in evaluation?*

Anyone involved in the programme will have a contribution to make to its evaluation. Out of these experiences, new ideas and ways of delivery could be sought. The Training Programme Director would typically co-ordinate the process with administrative support.

Local training programme committees, radiology schools and local faculties are best placed to analyse the results of evaluation.

Trainee involvement in curriculum review will be facilitated through:

- Involvement of trainees in local faculties of education
- Trainee involvement in the Specialty Training Board
- Informal feedback during appraisal, ARCP and College meetings

*When should evaluation occur?*

Evaluation should be embedded in the training programme. It is an annual process. Some 'data' will be collected throughout the year, eg evaluation of teaching sessions, whilst other 'data' can be collected at a single time point, eg review of ePortfolios. The various strands of evidence will need to be summarised, analysed and formulated in time for response to the GMC survey, deanery report and recommendations for programme development.

*What to look for?*

Evaluation should be broad ranging in terms of individuals and sources without obstructing education or compromising confidentiality. There should be ample opportunities for qualitative and quantitative data analysis. The following are suggestions for sources of information to inform the evaluation process:

<b>Category</b>	<b>Sub-category</b>	<b>Sources/methods of data collection</b>
<b>Stakeholder Views</b>	Trainees	GMC Survey/Local Trainee Questionnaire/Structured Interview/Trainee Representation at LEB
	Trainers	GMC Survey/Local Trainer Questionnaire/Structured Interview/LEB minutes/review of MSF
	Support Staff	Structured Interview/Local Support Staff Questionnaire
	Clinicians	Audit of Opinions
	Patients	Departmental Patient Satisfaction Survey
<b>Teaching</b>	Formal	Trainee Attendance Record/Teacher Attendance Record/Evaluation Forms/GMC Survey
	Opportunistic	GMC Survey/Quality and ease of completion of WpBA
	Self Directed	GMC Survey/Local Trainee Questionnaire / Study Leave Records / Access to e-learning / Structured Interview /
<b>Teaching Experience</b>		Review of Outputs of Teaching Observation Tool / Structured Interview / Local Trainee Questionnaire

<b>Supervision</b>	Clinical	GMC Survey / Local Trainee Questionnaire / ePortfolio review / Trainer Qualification Record / Peer Observation / Review of Job Plans
	Educational	GMC Survey / Local Trainee Questionnaire / ePortfolio review / Trainer Qualification Record / Peer Observation / Review of Job Plans
<b>Clinical</b>	Induction	GMC Survey / Trainee Rep / Local Trainee Questionnaire
	Workload	Logbook or PACS data / Rota review / GMC Survey / Local Trainee Questionnaire / Trainee Rep at LEB / Structured Interview / Diary Card Exercise
	Support	GMC Survey / Local Trainee Questionnaire / Trainee Rep at LEB / Structured Interview / Discrepancy Audit / Complaints /
<b>Audit</b>		Review of Portfolios / Review of Audit Observation Tool / Structured Interview / Local Trainee Questionnaire
<b>Research</b>		Review of Portfolios / Structured Interview / Local Trainee Questionnaire
<b>Other</b>		Ratio of Applicant to places for training scheme / Attrition rate / FRCR success rate / CCT Success / Consultant Interview Success

Monitoring and reporting will be the responsibility of the Programme Directors within the local faculties of education and Heads of Schools.

The Specialty Training Board (STB) of the Faculty of Clinical Radiology will oversee central evaluation of this curriculum and the ePortfolio. The curriculum should be regarded as a living document and the STB will ensure that it will be able to respond swiftly to new developments. The outcome of these evaluations will inform the future development of the curriculum.

The Curriculum Committee will undertake the practical aspects of curriculum review. The Curriculum Committee is a sub-committee of the Specialty Training Board.

## **APPENDIX C: EQUALITY AND DIVERSITY**

The Royal College of Radiologists will comply, and ensure compliance, with the requirements of the Equality Act 2010

The Royal College of Radiologists believes that equality of opportunity is fundamental to all radiological practice and to the many and varied ways in which individuals become involved with the College, either as members of staff and Officers; as advisers from the medical profession or in a lay capacity; as members of the College's professional bodies or as radiologists in training and examination candidates. Accordingly, it warmly welcomes contributions and applications from as diverse a population as possible, and actively seeks to recruit people to all its activities regardless of race, religion, ethnic origin, disability, age, gender or sexual orientation.

Deanery quality assurance will ensure that each training programme complies with the equality and diversity standards in postgraduate medical training as set by GMC.

Compliance with anti-discriminatory practice will be assured through

- monitoring of recruitment processes;
- ensuring all College representatives and TPDs have attended appropriate training sessions prior to appointment or within 12 months of taking up post;
- ensuring trainees have an appropriate, confidential and supportive route to report examples of inappropriate behaviour of a discriminatory nature;
- monitoring of College Examinations;
- ensuring all assessments discriminate on objective and appropriate criteria and do not unfairly disadvantage trainees because of gender, ethnicity, sexual orientation or disability (other than that which would make it impossible to practise safely as a radiologist). All efforts shall be made to ensure the participation of people with a disability in training.

The Royal College of Radiologists takes its obligations under the relevant equal opportunities legislation seriously. This includes ensuring that members of staff involved in the delivery of examinations receive appropriate briefing on the implications of race equality in the treatment of candidates.

Those appointed as examiners must demonstrate that they have undergone appropriate equality and diversity training and that they are willing to abide by good practice in these areas.

The RCR has an Adjustments Procedure for FRCR Examinations published on our website which provides a formal means for candidates to submit a request for an adjustment to be applied in examinations to compensate for disability. All adjustment requests will be considered by the College in a fair and consistent way

For implementation see Generic curriculum – Maintaining GMP: Equality & Diversity

## **APPENDIX D: CHANGES SINCE PREVIOUS VERSIONS**

### **Changes between 2007 And 2010**

The curriculum has undergone wholesale re-design since 2007. There are fundamental changes in terms of the underpinning educational ethos, the development of mapped assessments and incorporation of the domains of Good Medical Practice. These significant overarching changes have come after feedback from GMC surveys, the Tooke Report and as a result of wide consultation.

#### **Structural changes**

- The whole curriculum has been developed in educational terms in a spiral fashion (core, level1 & 2) with full integration of both generic and radiology specific content.
- There is incorporation and integration of the medical leadership and health inequalities competences.
- The updated layout brings the syllabus, competences and accompanying assessment to the forefront. This will facilitate easier navigation for the principal users, ie trainees and trainers.

#### **Assessment**

- Workplace based assessment methodology has been developed and radiology specific tools introduced and piloted.
- Specified assessments have been directly linked to each competence, where possible with existing tools.
- In the assessment tools, separate descriptors have been written for all grades core, level 1 and level 2.
- Generic assessment tools for teaching skills and audit assessment have been included.
- Generic skills across the domains of Good Medical Practice are to be assessed by the inclusion of a Multi-Source Feedback tool (MSF)
- Clarification of educational and clinical supervisor roles and responsibilities.
- A logbook has been incorporated into the ePortfolio to record competence in procedural skills.

#### **Syllabus and competences**

- Inclusion of a new generic competencies section, which underpins all medical practice and brings together attitudes and behaviours desirable in all radiologists.
- Development of the rationale of common presentations/diagnoses as providing the way of bringing the curriculum to life.
- Comprehensive mapping of all assessments (summative and formative) onto the syllabus contents.

### ***Changes between 2010 and 2012***

Added new sections:

- 1.3 Enrolment with RCR,
- 1.4 Duration of Training
- 1.5 Flexible Training, including latest GMC guidance
- 1.6 Research, including new requirement for a research project.

ARCP Decision Aid includes new requirement for a research project

Clarification of Appendix C

Removed Appendix D (Examination policies) as this was too much detail to be in curriculum and at risk of being outdated. Up to date exams information is on the RCR website.

### ***Changes between 2012 and 2013***

The physics, anatomy, generic and specialty specific elements of the curriculum have been revised, to remove components no longer relevant to current practice in clinical radiology and to add relevant new elements.

The generic competences were amended from Core, Level 1 and Level 2, to “Core” and by “completion of specialty training”.

Elements of the curriculum which were duplicated have been rationalised and reference to extant guidance has been added.

A new assessment tool has been included – the MDTA.