

# **Sample Learning Objectives for a Medical School Radiology Curriculum: Listed by Courses**

- This document lists sample learning objectives in groupings appropriate for different medical school settings including the pre-clinical years, general radiology courses, and subspecialized electives
- The numerical ranking in parenthesis following each learning objectives represents the Bloom's Taxonomy "level" as outlined below:

Level 1: Knowledge  
Level 2: Comprehension  
Level 3: Application  
Level 4: Analysis  
Level 5: Synthesis  
Level 6: Evaluation

## **First and Second Year (Pre-clinical or Core Curriculum)**

### **General Radiologic Concepts**

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Compare and contrast the benefits and limitations of different radiologic modalities including: Plain film, CT, Ultrasound, MR, Nuclear medicine (4)

List risks associated with radiation exposure (1)

Describe the impact of patient age on radiation sensitivity (2)

Compare the relative radiation dose delivered by different imaging modalities and contrast these with annual rates of background radiation exposure (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Describe the specific circumstances in which a multiphase CT (“with and without contrast”) may be useful and list reasons why this type of scan is not performed routinely (2)

List two imaging modalities with no proven risk to the fetus in a pregnant patient (1)

### **Anatomy Correlation**

Recognize normal anatomic structures of the chest on imaging exams and become familiar with the range of normal appearances (1)

Recognize abdominal organs on cross sectional imaging studies (1)

Identify and name the major parts of the following bones on x-ray: Humerus, radius, ulna, carpal bones, metacarpals and phalanges, femur, fibula, tibia, tarsal bones, calcaneus, metatarsals, vertebrae, ribs, pelvis, clavicles and scapulae (1)

Identify normal anatomic structures of the head and neck, brain, and spine on imaging exams and compare the degree of anatomic detail between CT and MR (1)

### **Chest X-ray Basics**

Employ a systematic search pattern for interpreting chest x-rays (3)

Identify the different CXR views and describe when they are helpful, as well as the limitations of each (1)

List different types of pathologies that can produce an “opacity” on chest x-ray (1)

Identify consolidation on CXR and formulate a differential diagnosis for the appearance (1)

Discuss CXR findings that may help characterize a lung opacity as atelectasis (2)

Recognize a pleural effusion at CXR on supine, upright, and decubitus films (1)

Describe signs of a pneumothorax at CXR (2)

### **Abdominal X-ray Basics**

Use a systematic search pattern for interpreting an abdominal plain film (3)

Recognize the correct and incorrect positioning of feeding tubes (1)

Recognize free intra-abdominal air on plain film and describe how patient positioning may affect sensitivity for its detection (1)

Differentiate between dilated small bowel and large bowel on plain film (4)

### **General Clinical Radiology Elective or Core Radiology Rotation**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Compare and contrast the benefits and limitations of different radiologic modalities including: Plain film, CT, Ultrasound, MR, Nuclear medicine (4)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

List risks associated with radiation exposure (1)

Describe the impact of patient age on radiation sensitivity (2)

Compare the relative radiation dose delivered by different imaging modalities and contrast these with annual rates of background radiation exposure (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Describe the specific circumstances in which a multiphase CT (“with and without contrast”) may be useful and list reasons why this type of scan is not performed routinely (2)

Employ a systematic search pattern for interpreting chest x-rays (3)

Recognize normal anatomic structures of the chest on imaging exams and become familiar with the range of normal appearances (1)

Identify the different CXR views and describe when they are helpful, as well as the limitations of each (1)

List different types of pathologies that can produce an “opacity” on chest x-ray (1)

Identify consolidation on CXR and formulate a differential diagnosis for the appearance (1)

Describe signs of a pneumothorax at CXR (2)

Differentiate between pulmonary vascular congestion, interstitial pulmonary edema, and alveolar edema on CXR (3)

Use a systematic search pattern for interpreting an abdominal plain film (3)

Recognize the correct and incorrect positioning of feeding tubes (1)

Describe what a patient experiences during a gastrointestinal fluoroscopic procedure (2)

Recognize free intra-abdominal air on plain film and describe how patient positioning may affect sensitivity for its detection (1)

Differentiate between dilated small bowel and large bowel on plain film (4)

Describe clinical scenarios where GI endoscopy would be more appropriate than a fluoroscopic radiologic procedure (2)

Summarize the risks and benefits of screening mammography (2)

Discuss current recommendations for screening mammography (2)

List the indications for a diagnostic mammogram (1)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: suspected pneumonia, suspected pulmonary embolism, solitary pulmonary nodule, lung cancer staging, screening for metastasis, suspected aortic dissection, renal colic, suspected appendicitis, hematuria, right upper quadrant pain, pancreatitis, suspected small bowel obstruction, suspected diverticulitis, pelvic pain in a woman, trauma, suspected osteomyelitis, suspected stroke, seizure (5)

### **Chest Radiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Describe the specific circumstances in which a multiphase CT (“with and without contrast”) may be useful and list reasons why this type of scan is not performed routinely (2)

Employ a systematic search pattern for interpreting chest x-rays (3)

Recognize normal anatomic structures of the chest on imaging exams and become familiar with the range of normal appearances (1)

Identify the different CXR views and describe when they are helpful, as well as the limitations of each (1)

List different types of pathologies that can produce an “opacity” on chest x-ray (1)

Identify consolidation on CXR and formulate a differential diagnosis for the appearance (1)

Discuss CXR findings that may help characterize a lung opacity as atelectasis (2)

Recognize a pleural effusion at CXR on supine, upright, and decubitus films (1)

Describe signs of a pneumothorax at CXR (2)

Differentiate between pulmonary vascular congestion, interstitial pulmonary edema, and alveolar edema on CXR (3)

Discuss the criteria for diagnosis of cardiomegaly on CXR (2)

Compare the conspicuity of chest “masses” on CXR and CT (4)

Recognize the correct positioning of feeding tubes, venous lines and endotracheal tubes on chest x-ray, and likewise recognize incorrect positioning (1)

List several clinical scenarios in which imaging of the chest can be used to guide procedures (1)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: suspected pneumonia, suspected pulmonary embolism, solitary pulmonary nodule, lung cancer staging, screening for metastasis, suspected aortic dissection (5)

Choose an appropriate imaging protocol (Non-contrast CT vs. Contrast enhanced CT vs. Multiphase CT) for common cardiothoracic indications (3)

## **Abdominal Radiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), hyperechoic, hypoechoic, signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Describe the specific circumstances in which a multiphase CT (“with and without contrast”) may be useful and list reasons why this type of scan is not performed routinely (2)

Use a systematic search pattern for interpreting an abdominal plain film (3)

Recognize the correct and incorrect positioning of feeding tubes (1)

Describe what a patient experiences during a gastrointestinal fluoroscopic procedure (2)

Recognize free intra-abdominal air on plain film and describe how patient positioning may affect sensitivity for its detection (1)

Differentiate between dilated small bowel and large bowel on plain film (4)

Identify clinical scenarios where abdominal imaging might be used to guide procedures (1)

Describe clinical scenarios where GI endoscopy would be more appropriate than a fluoroscopic radiologic procedure (2)

Choose an appropriate imaging protocol (Non-contrast CT vs. Contrast enhanced CT vs. Multiphase CT) for common abdominal indications (3)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: renal colic, suspected appendicitis, hematuria, right upper quadrant pain, pancreatitis, suspected small bowel obstruction, suspected diverticulitis, pelvic pain in a woman (5)

## **Musculoskeletal Radiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), hyperechoic, hypoechoic, signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Identify and name the major parts of the following bones on x-ray: Humerus, radius, ulna, carpal bones, metacarpals and phalanges, femur, fibula, tibia, tarsal bones, calcaneus, metatarsals, vertebrae, ribs, pelvis, clavicles and scapulae (1)

Differentiate between the metaphysis, diaphysis, and epiphysis of a long bone on x-ray (2)

Use proper terminology when describing a fracture (3)

Explain the significance of intra-articular extension or physeal involvement of a fracture (2)

Recognize a non-displaced fracture on x-ray (1)

Explain the importance of multiple x-ray views in fracture diagnosis (2)

Identify an elbow joint effusion on x-ray (1)

Differentiate between anterior and posterior dislocation of the shoulder on x-ray (2)

Describe clinical scenarios where image guided musculoskeletal procedures may be beneficial (2)

Discriminate between the general types of injuries best evaluated by plain film, CT, or MR (4)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: chronic joint pain or suspected arthritis, chronic back pain, acute back pain, trauma, neck trauma, occult hip fracture, suspected osteomyelitis, screening for metastatic disease (5)

## **Vascular and Interventional Radiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), hyperechoic, hypoechoic, signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam or interventional procedure at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam or procedure request requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Explain what takes place during an imaging guided biopsy in terms a patient would understand (2)

Relate indications for placement of an IVC filter (1)

List laboratory studies that are often required prior to an interventional radiology procedure (1)

List benefits and limitations of the following types of angiographic studies: CTA, MRA, conventional angiogram (1)

Describe how different imaging modalities are used to guide procedures and list one or two clinical scenarios where each (ultrasonography, fluoroscopy, CT, MRI) is used (2)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: Suspected aortic aneurysm, peripheral vascular disease, renal artery stenosis, carotid stenosis, GI bleed, bowel ischemia (5)

## **Emergency Radiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Describe the specific circumstances in which a multiphase CT (“with and without contrast”) may be useful and list reasons why this type of scan is not performed routinely (2)

Employ a systematic search pattern for interpreting chest x-rays (3)

Recognize normal anatomic structures of the chest on imaging exams and become familiar with the range of normal appearances (1)

Identify consolidation on CXR and formulate a differential diagnosis for the appearance (1)

Describe signs of a pneumothorax at CXR (2)

Differentiate between pulmonary vascular congestion, interstitial pulmonary edema, and alveolar edema on CXR (3)

Discuss the role of abdominal ultrasound in the assessment of an acute trauma patient (2)

Review criteria for performing CT in trauma patient (2)

Recognize abnormal spinal-laminar alignment of the cervical spine at x-ray (1)

Identify emergent clinical scenarios where image-guided procedures may be beneficial (1)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: suspected pneumonia, suspected pulmonary embolism, suspected aortic dissection, renal colic, suspected appendicitis, hematuria, right upper quadrant pain, pancreatitis, suspected small bowel obstruction, suspected diverticulitis, pelvic pain in a woman, acute back pain, bone or joint trauma, neck trauma, suspected stroke, head trauma, spine trauma (5)

### **Women's Imaging Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), hyperechoic, hypoechoic, signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or "wet" read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Summarize risks and contraindications unique to MR examinations (2)

Explain how a mammogram is performed in terms a patient would understand (2)

Differentiate between CC and MLO positioning on a mammogram (2)

Explain the rationale for breast compression in mammography (2)

Compare the role of screening mammography versus diagnostic mammography (4)

List the indications for a diagnostic mammogram (1)

Summarize the risks and benefits of screening mammography (2)

Discuss current recommendations for screening mammography (2)

Describe the utility of ultrasound in the work-up of a breast mass (2)

List potential indications for breast MR (1)

Name the most common indication for a hysterosalpingogram (1)

Explain the advantages of transvaginal ultrasonography compared to a transabdominal pelvic ultrasound (2)

Schedule fetal ultrasounds at the appropriate diagnostic intervals (3)

Estimate the accuracy of ultrasound for pregnancy dating (2)

Describe the limitations of ultrasound for prenatal diagnosis (2)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: First trimester vaginal bleeding, post menopausal vaginal bleeding, female pelvic pain, staging of gynecologic malignancies (5)

## **Ultrasound Elective**

Define the descriptive terms hyperechoic, isoechoic, and hypoechoic (1)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Summarize the benefits and limitations of ultrasound as an imaging modality (2)

List diagnostic and therapeutic procedures that are commonly performed with ultrasound guidance (1)

Perform ultrasound to guide simple procedures (Psychomotor domain)

Describe the ultrasound findings of deep venous thrombosis (DVT) (2)

Explain why ultrasound is a good modality for assessing vascular structures (2)

Explain the advantages of transvaginal ultrasonography compared to a transabdominal pelvic ultrasound (2)

Schedule fetal ultrasounds at the appropriate diagnostic intervals (3)

Estimate the accuracy of ultrasound for pregnancy dating (2)

Describe the limitations of ultrasound for prenatal diagnosis (2)

Describe the role of ultrasound in the workup of the following symptoms: Right upper quadrant pain renal colic, suspected appendicitis, evaluation of a breast mass, first trimester vaginal bleeding, post menopausal vaginal bleeding, female pelvic pain, testicular torsion

## **Neuroradiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), hyperechoic, hypoechoic, signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would be reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Discuss the potential complications of intravenous contrast administration for CT and MR exams and identify predisposing risk factors (2)

Describe different methods for reducing the risk of contrast nephropathy (2)

Summarize risks and contraindications unique to MR examinations (2)

Identify normal anatomic structures of the head and neck, brain, and spine on imaging exams and compare the degree of anatomic detail between CT and MR (1)

Recognize normal age related changes in the brain at imaging  
Describe the strengths, weaknesses and limitations of CT vs. MRI in the evaluation of patient's with central neurologic symptoms and diseases (1)

List some indications for contrast enhanced MRI and CT (1)

Recognize imaging signs of increased intracranial pressure (1)

Discriminate between a subdural and epidural hematoma at CT (4)

Describe imaging signs of a subarachnoid hemorrhage (2)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: suspected stroke, suspected subarachnoid hemorrhage, head trauma, spine trauma, facial trauma, metastatic disease to the CNS, seizures, dementia, brain tumor follow up, sinus disease (5)

## **Nuclear Medicine Elective**

Describe the procedure for ordering a nuclear medicine exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or "wet" read and the final radiologic report (1)

Predict types of imaging findings that would reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Explain the difference between a radioisotope and a radiotracer (2)

Recognize common images from common Nuclear medicine studies (examples: bone scan, PET scan, V/Q scan) (1)

List common clinical indications for a bone scan (1)

Recall tumor types that may be associated with a false negative bone scan (1)

Contrast the accuracy of a V/Q scan and PE protocol CT for diagnosis of pulmonary embolism (2)

Describe what occurs during a gastric emptying study (2)

Discuss some limitations of nuclear medicine studies (2)

Name a therapeutic use of nuclear medicine (1)

Analyze the role of nuclear medicine studies in the work up of common clinical scenarios including: Acute cholecystitis, GI bleeds, suspected occult fractures, osteomyelitis (4)

## **Pediatric Radiology Elective**

Define terms commonly used in radiology reports including: lucency, opacity, attenuation, Hounsfield units (HU), hyperechoic, hypoechoic, signal (1)

Categorize different tissues from most to least opaque on x-ray including: bone, soft tissue, air, metal, and fat. (3)

Describe the procedure for ordering a radiologic exam at your institution (2)

Summarize the categories of critical information that must be included on an imaging exam requisition (2)

State the difference between a preliminary or “wet” read and the final radiologic report (1)

Predict types of imaging findings that would reported directly to the ordering physician versus those which would appear only in the transcribed radiologic report (4)

Distinguish between the different types of contrast used in imaging exams and the potential diagnostic benefits of each (4)

Summarize risks and contraindications unique to MR examinations (2)

Describe the specific circumstances in which a multiphase CT (“with and without contrast”) may be useful and list reasons why this type of scan is not performed routinely (2)

Discuss challenges specific to imaging children and how these may affect choice of imaging modality (2)

Contrast normal anatomy on a chest x-ray of an infant compared to an adult (2)

Identify consolidation on CXR and formulate a differential diagnosis for the appearance (1)

Recognize growth plates as a normal finding (1)

Explain the significance of physeal involvement of a fracture (2)

List types of injuries that should raise suspicion for non-accidental trauma (1)

Describe the process of and indications for performing a voiding cystourethrogram (VCUG) (1)

Construct the appropriate imaging algorithm for common diagnostic scenarios including: Suspected pyloric stenosis, intussusception, vomiting, suspected testicular torsion, and joint pain or limping (5)