

# What's New in 10 Years? A Revised Cardiothoracic Curriculum for Diagnostic Radiology Residency with Goals and Objectives Related to General Competencies

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This is a cardiothoracic curriculum document for radiology residents meant to serve not only as a study guide for radiology residents but also as a teaching and curriculum reference for radiology educators and radiology residency program directors. This document represents a revision of a cardiothoracic radiology resident curriculum that was published 10 years ago in *Academic Radiology*. The sections that have been significantly revised, expanded, or added are (1) lung cancer screening, (2) lung cancer genomic profiling, (3) lung adenocarcinoma revised nomenclature, (4) lung biopsy technique, (5) nonvascular thoracic magnetic resonance, (6) updates to the idiopathic interstitial pneumonias, (7) cardiac computed tomography updates, (8) cardiac magnetic resonance updates, and (9) new and emerging techniques in cardiothoracic imaging. This curriculum was written and endorsed by the Education Committee of the Society of Thoracic Radiology. This curriculum operates in conjunction with the Accreditation Council for Graduate Medical Education (ACGME) milestones project that serves as a framework for semiannual evaluation of resident physicians as they progress through their training in an ACGME-accredited residency or fellowship programs. This cardiothoracic curriculum document is meant to serve not only as a more detailed guide for radiology trainees, educators, and program directors but also complementary to and guided by the ACGME milestones.

**Key Words:** curriculum; cardiothoracic; radiology residency; Accreditation Council for Graduate Medical Education (ACGME); American Board of Radiology (ABR); study guide; examination.

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## INTRODUCTION

This document is a revision of a previously published cardiothoracic curriculum for diagnostic radiology residency (1) and reflects interval changes in the clinical practice of cardiothoracic radiology, including updates in the Accreditation Council for Graduate Medical Education (ACGME) requirements for diagnostic radiology training programs.

Radiology residency programs must define the specific knowledge, skills, behaviors, and attitudes required of residents and must provide adequate educational experience to achieve competency in six areas defined by the ACGME: (1) patient care (PC), (2) medical knowledge (MK), (3) professionalism (P), (4) interpersonal/communication skills (ICS), (5) practice-based learning and improvement (PBLI), and (6) systems-based practice (SBP). These six areas, as they specifically relate to radiology, have been previously published (2).

The 10 subspecialty areas of radiology residency, as defined by the ACGME, are neuroradiology, musculoskeletal radiology,

vascular and interventional radiology, *cardiac radiology* (new since 2005), chest radiology, breast imaging, abdominal radiology, pediatric radiology, ultrasound (including obstetrical ultrasound and vascular), and nuclear medicine.

The Society of Thoracic Radiology (STR) Education Committee has responded to the changing practice of cardiothoracic imaging and the revised ACGME guidelines by revising the previously published Cardiothoracic Curriculum document. There have also been important changes to the structure of radiology residencies across the United States since the last curriculum document was published (1). The STR Education Committee decided to keep the structure of the curriculum document divided into years 1 and 2, then years 3 and 4 combined, recognizing that the new residency format with general and subspecialty years may not allow a trainee to achieve all the educational goals and objectives in years 3 and 4 if the trainee has not selected cardiothoracic imaging as a subspecialty. Ideally, the third and fourth rotations must occur in year 3 or very early in year 4 so that both occur before the new core American Board of Radiology (ABR) examination that typically occurs early in year 4.

This curriculum document is focused on adult cardiothoracic imaging, as pediatric radiology is considered a separate subspecialty by the ACGME. There is overlap, however, between cardiothoracic imaging and other ACGME subspecialties and, where appropriate, components of other ACGME subspecialties, such as ultrasound or vascular and interventional radiology, are also included. Educational objectives for physics are not included in this document, as most radiology residencies include a physics course with its own course objectives.

In this document, learning goals and objectives that relate to clinical knowledge, technical, communication, and decision-making skills are outlined for each year of training.

Six general competencies have been defined by the ACGME (2,3). Throughout this document, the following abbreviations for the six specific competencies are used: PC, MK, P, ICS, PBLI, and SBP.

The ACGME has recently completed a milestone project to describe competency-based developmental outcomes with several purposes. For the radiology residency training programs (as well as fellowship programs), the ACGME milestones serve as a framework for Clinical Competency Committees and guide curriculum development as well as aid identification of struggling resident trainees. For the resident trainees, the milestones clearly outline expectations for performance and facilitate self-directed learning and assessment. For accreditation purposes, the ACGME milestones allow for continuous monitoring of training programs and increased public accountability by facilitating reporting of national aggregate competency outcomes according to each subspecialty.

This cardiothoracic curriculum for radiology residents operates in conjunction with the ACGME milestones project that serves as a framework for semiannual evaluation of resident physicians as they progress through their training in an ACGME-accredited residency or fellowship program. This cardiothoracic curriculum document is meant to serve not only as a more detailed guide

for radiology trainees, educators, and program directors but also is complementary to and guided by the ACGME milestones.

The Entrustable Professional Activities (EPAs) are “units of professional practice, defined as tasks or responsibilities that trainees are entrusted to perform unsupervised once they have attained competence. EPAs are independently executable, observable, and measurable in their process and outcome, and, therefore, suitable for entrustment decisions.” EPAs may incorporate multiple competencies as they describe the tasks a particular specialist should be able to complete without supervision upon graduation from residency and fellowship. The medical knowledge, interpretative, and procedural skills outlined in this cardiothoracic curriculum document reflect the EPAs outlined by the ACGME milestones project that should be achieved by a radiology resident during the course of the residency.

This curriculum document is based on three 4-week rotations in cardiothoracic imaging. Residency training programs may organize these blocks into different numbers of cardiac, thoracic, or cardiothoracic blocks of varying length. It is the hope of the STR Education Committee that this document will be comprehensive yet adaptable across many variations in residency training programs worldwide. Because the timing of the rotations and whether they are purely thoracic, cardiac, or cardiothoracic in nature may vary across training programs, individual training programs may adapt this document to their practice, as needed.

The sections that have been significantly revised and expanded or newly added to the previously published curriculum are (1) lung cancer screening, (2) lung cancer genomic profiling, (3) lung adenocarcinoma revised nomenclature, (4) lung biopsy technique, (5) thoracic magnetic resonance (MR), (6) updates to the idiopathic interstitial pneumonias, (7) cardiac computed tomography (CT) updates, (8) cardiac MR updates, and (9) new and emerging techniques in cardiothoracic imaging (Table 1).

Lung cancer screening programs have developed since the last publication of the cardiothoracic resident curriculum based on results of large population-based studies such as the National Lung Screening Trial. This landmark trial demonstrated a 20% relative reduction in lung cancer mortality using low-dose CT lung cancer screening as compared to single-view, posteroanterior chest radiography (4). It is therefore important for radiology residents to be familiar with not only the benefits of CT lung cancer screening but also the reporting terminology and management recommendations according to the American College of Radiology (ACR)-endorsed Lung Imaging Reporting and Data System (5,6).

In recent years, the treatment of lung cancer has become more tailored to the specific genetic mutations expressed by the lung tumors. For example, for patients with metastatic non-small cell lung cancers (especially adenocarcinoma), testing for epidermal growth factor receptor (EGFR) mutations has helped identify patients who will benefit from EGFR (tyrosine kinase) inhibitors (ie, gefitinib) rather than standard chemotherapy. For the radiologist and the radiology trainee, it is important to understand that more cellular content in the fine needle aspirate or more core tissue biopsy samples are required to allow for genetic testing. More detail on lung biopsy technique

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