

## TRAINING STATEMENT

# COCATS 4 Task Force 10: Training in Cardiac Catheterization



*Endorsed by the Society for Cardiovascular Angiography and Interventions*

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## 1. INTRODUCTION

### 1.1. Document Development Process

#### 1.1.1. Writing Committee Organization

The writing committee was selected to represent the American College of Cardiology (ACC) and the Society for Cardiovascular Angiography and Interventions (SCAI) and included a cardiovascular training program director, an interventional cardiology training program director, an early-career cardiologist, highly-experienced specialists representing both the academic and community-based practice settings, and physicians experienced in defining and applying training standards according to the 6 general competency domains promulgated by the Accreditation Council for Graduate Medical Education (ACGME) and American Board of Medical Specialties (ABMS) and endorsed by the American Board of Internal Medicine (ABIM). The ACC determined that relationships with industry or other entities were not relevant to the creation of this general cardiovascular training statement. Employment and affiliation details for authors and peer reviewers are provided in [Appendixes 1 and 2](#), respectively, along with disclosure reporting categories. Comprehensive disclosure information for all authors, including relationships with industry and other entities, is available as an [online supplement](#) to this document.

#### 1.1.2. Document Development and Approval

The writing committee developed the document, approved it for review by individuals selected by the ACC and SCAI, and addressed the peer reviewers' comments. The document was revised and posted for public comment from December 20, 2014, to January 6, 2015. Authors addressed the additional comments from the public to complete the document. The final document was approved by the Task Force, COCATS Steering Committee, and ACC Competency Management Committee; ratified by the ACC Board of Trustees in March, 2015; and endorsed by the SCAI. This document is considered current until the ACC Competency Management Committee revises or withdraws it.

### 1.2. Background and Scope

The role of the cardiac catheterization laboratory in trainee education and clinical care continues to evolve. The cardiac catheterization laboratory serves as both a diagnostic and therapeutic facility. This document addresses training in diagnostic cardiac catheterization (invasive cardiology) as distinct from therapeutic catheterization (interventional cardiology). The catheterization laboratory has an important diagnostic role in the evaluation and management of all types of cardiovascular disease (i.e., coronary, structural heart, primary myocardial, peripheral, and cerebrovascular diseases). This role includes invasive hemodynamic measurements and angiographic delineation of cardiovascular anatomy and pathology. The information derived from these studies overlaps with and complements that derived from noninvasive diagnostic modalities such as echocardiography, nuclear imaging, computed tomography, and magnetic resonance imaging. This relationship has value in

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both enhancing diagnostic accuracy and fostering the understanding of cardiovascular anatomy, pathology, physiology, and pathophysiology. The widespread use of echocardiography in addition to the growing use of cardiovascular magnetic resonance and computed tomography angiography has also changed the practice of invasive and interventional cardiology. Patients with diagnostic, echocardiographic, or hemodynamic assessment of valvular or myocardial/pericardial disease may be referred for diagnostic coronary angiography only; however, patients in whom echocardiographic findings are inconclusive are still referred to the catheterization laboratory for hemodynamic assessment. These patients are often exceedingly complex. Thus, even in this era of enhanced noninvasive imaging, the understanding and proper performance of detailed hemodynamic evaluation in such patients remains critical.

The therapeutic role of the cardiac catheterization laboratory continues to grow as interventional cardiovascular procedures are applied to increasingly complex and critically ill patients. Urgent catheterization and percutaneous revascularization are now considered the standard of care for patients with acute coronary syndromes, ST-elevation myocardial infarction, and cardiogenic shock. Furthermore, new adjunctive pharmacologic regimens and interventional diagnostic and therapeutic devices have emerged. In addition, many noncoronary therapeutic procedures—including percutaneous closure of atrial septal defects, valve repair or replacement, alcohol septal ablation, and peripheral vascular procedures—are performed frequently. These procedures, together with the use of left ventricular assist and support devices, have significantly expanded the scope of interventional cardiology. This evolution has increased the cognitive and technical knowledge base required of invasive and interventional cardiologists. It is essential that all cardiologists understand the appropriate applications of invasive and interventional cardiology and that those planning to practice these disciplines achieve the knowledge and skills needed for advanced training. Consequently, this document revises and updates the standards for training in cardiac catheterization during the 3-year cardiovascular disease training program (1).

In addition to the cardiovascular disease examination, the ABIM provides a certifying examination in interventional cardiology (2), and the Residency Review Committee of the ACGME has a formal accreditation mechanism for interventional cardiovascular training programs (3). In 1999, the ACC published a training statement on recommendations for the structure of an optimal adult interventional cardiovascular training program (4), and the recommendations to prepare for advanced training in interventional cardiology are updated in this document. The recommendations in this

document are consistent with the requirements of the ABIM, ACGME, and ABMS. This document covers training in cardiac catheterization, and the ACC/American Heart Association (AHA)/American College of Physicians clinical competence statement on coronary artery interventional procedures covers training in interventional cardiology (5).

Training in diagnostic cardiac catheterization must occur and be able to be completed within a cardiovascular training program that is fully accredited by the ACGME. If the program does not include an accredited training program in interventional cardiology, exposure to an active interventional cardiovascular program should be provided. All invasive cardiovascular training programs in the United States must satisfy the basic standards developed by the ACGME in order for the candidates to be eligible for the ABIM's clinical cardiovascular certificate. The ACGME standards represent the qualifying requirements. COCATS 4 endorses the ACGME standards for program accreditation and makes additional recommendations over and above those standards.

The ultimate goal of a cardiac catheterization training program is to teach the requisite cognitive and technical knowledge of invasive cardiology. This includes indications and contraindications for the procedures, procedural skills, preprocedure and postprocedure care, management of complications, and analysis and interpretation of hemodynamic and angiographic data. The cardiac catheterization laboratory provides a platform for teaching the core knowledge base of cardiac anatomy, pathology, physiology, and pathophysiology that all cardiologists should possess regardless of whether they perform invasive cardiovascular procedures. In addition, it is this experience that provides the basic intravascular catheter insertion and manipulation skills needed to care for cardiac patients in critical care environments.

The Task Force was charged with updating previously published standards for training fellows in cardiology enrolled in cardiac fellowship programs on the basis of changes in the field since 2008 (1) and as part of a broader effort to establish consistent training criteria across all aspects of cardiology. The Task Force also updated previously published standards to address the evolving framework of competency-based medical education described by the ACGME Outcomes Project and the 6 general competencies endorsed by ACGME and ABMS. The background and overarching principles governing fellowship training are provided in the COCATS 4 Introduction, and readers should become familiar with this foundation before considering the details of training in a subspecialty like cardiac catheterization. The Steering Committee and Task Force recognize that implementation of these changes in training requirements will occur incrementally.

For most areas of adult cardiovascular medicine, 3 levels of training are delineated:

- **Level I training**, the basic training required of trainees to become competent consultant cardiologists, is required of all cardiovascular fellows and can be accomplished as part of a standard 3-year training program in cardiology. In the case of cardiac catheterization, Level I represents training for those who will practice noninvasive cardiology and whose invasive activities will be confined to critical care unit procedures. This level will also provide training in the indications for the procedure and in the accurate interpretation of data obtained in the catheterization laboratory.
- **Level II training** refers to the additional training in 1 or more areas that enables some cardiologists to perform or interpret specific procedures or render more specialized care for patients and conditions. This level of training is recognized for those areas in which an accepted instrument or benchmark, such as a qualifying examination, is available to measure specific knowledge, skills, or competence. Level II training in selected areas may be achieved by some trainees during the standard 3-year cardiovascular fellowship, depending on the trainees' career goals and use of elective rotations. It is anticipated that during a standard 3-year cardiovascular fellowship training program, sufficient time will be available for the trainee to receive Level II training in a specific subspecialty. In the case of cardiac catheterization and peripheral angiography, Level II is defined as training for those who will either practice diagnostic cardiovascular catheterization or pursue further training in interventional cardiology. Level II training may also be sought by those who aspire to advanced training in heart failure or electrophysiology. Notably, no certification examination currently exists to assess Level II competency in this field.
- **Level III training** requires additional training and experience beyond the cardiovascular fellowship in order for the trainee to acquire specialized knowledge and competencies in performing, interpreting, and training others to perform specific procedures or render advanced specialized care at a high level of skill. Level III training is described here only in broad terms to provide context for trainees and clarify that these advanced competencies are not covered during the cardiovascular fellowship and require additional training and designation by an independent certification board, often coupled with a certifying examination. Level III training cannot be obtained during the standard 3-year cardiovascular fellowship and requires additional exposure in a program that meets requirements that will be addressed in a subsequent,

separately published Advanced Training Statement (formerly Clinical Competence Statement).

In the case of interventional cardiology, Level III training is for those who will practice diagnostic, interventional cardiac, and peripheral vascular catheterization and is undertaken during a dedicated interventional cardiovascular training program. Level II training in vascular medicine (see COCATS 4 Task Force 9 report) is also suggested prior to or in conjunction with Level III training in catheter-based peripheral vascular intervention.

The number of procedures recommended at each level of training is based on published guidelines (6), competency statements (5,7), and the experience and opinions of the writing group. It is assumed that training is directed by appropriately qualified mentors in an ACGME-accredited program and that satisfactory completion of training is documented by the program director. The number of procedures and duration of training required for each level of training are summarized in [Section 4](#).

## 2. GENERAL STANDARDS

Several organizations, such as the ACC, AHA, American College of Physicians, and SCAI, have addressed training requirements and guidelines for interventional cardiology. The recommendations are congruent and address faculty, facility requirements, emerging technologies, and practice. We recommend strongly that candidates for the ABIM examination for certification in cardiovascular diseases, as well as those seeking certification in interventional cardiology, review the specific requirements of the ABIM (2).

### 2.1. Faculty

Faculty must be experienced and committed to the teaching program. All requirements for faculty are outlined in ABMS and ACGME documents (3). Exposure to multiple faculty mentors substantially enhances the quality of a training experience. The faculty should consist of a full-time training director, key faculty, and other associated faculty. An optimal program should have at least 3 key faculty members, 1 of whom is the training director, who devotes at least 20 hours per week to the program. Associated faculty may have varying levels of commitment and involvement in the program.

#### 2.1.1. Training Director

The training director for the diagnostic catheterization curriculum must be certified in cardiovascular medicine by the ABIM and should be recognized as an expert in cardiac catheterization. Preferably, the director should be a full-time faculty member of the overall cardiovascular training program, committed to medical education and teaching. If the director also serves as training director of interventional cardiology, certification in interventional

cardiology is required. The director should be responsible for the invasive teaching curriculum and overall teaching program in addition to trainee evaluation. If the program director is also the director of the catheterization laboratory, this individual should also be responsible for the administration of the laboratory, quality assurance, and radiation safety.

#### 2.1.2. Other Key Faculty

Key faculty members should be certified in cardiovascular medicine by the ABIM and have expertise in all aspects of diagnostic procedures, including the evaluation of coronary, valvular, congenital, cardiomyopathic and peripheral vascular disease, and should be familiar with complex hemodynamics in patients with all types of heart disease. The program faculty should include individuals with expertise in the performance of trans-septal catheterization, the interpretation and performance of intravascular imaging, and physiological assessment. If the program also provides training in interventional cardiology, its faculty must satisfy the requirements for programs in interventional cardiology by the ACGME (3) and the requirements outlined in the previously published ACC training statement (1). Ideally, the program should include faculty who possess skills in advanced interventional cardiovascular techniques, including interventional therapy of structural heart, peripheral arterial, and carotid artery disease.

#### 2.2. Facilities

All training facilities must be equipped and staffed to function in accordance with the ACC/AHA/SCAI clinical expert consensus document on cardiac catheterization laboratory standards (7).

#### 2.3. Equipment

##### 2.3.1. X-Ray Imaging Equipment

The cardiac catheterization laboratory must generate high-quality x-ray digital images during diagnostic and interventional catheterization procedures. Laboratories performing peripheral and carotid angiography must have digital subtraction angiography and appropriately sized image intensifiers (i.e., 12 in to 16 in). The laboratory must have access to the support personnel needed to ensure that image quality is optimal and that radiation exposure to patients and staff is both monitored and minimized. Radiation exposure to trainees must be carefully monitored on a monthly basis.

##### 2.3.2. Hemodynamic Monitoring and Recording Equipment

The facility must have high-quality physiological monitoring and recording equipment to permit accurate assessment of complex hemodynamic conditions. The presence of equipment for assessing both coronary

physiology, such as fractional flow reserve, and coronary and structural heart anatomy, such as intravascular and intracardiac ultrasound, is strongly recommended.

#### 2.4. Ancillary Support

The program must have on-site access to all core cardiovascular services, including a cardiac critical care facility, and echocardiography and stress testing with nuclear imaging. Complete electrophysiological testing onsite is desirable, but alternatively, it may be arranged by referral to an affiliated institution. On-site support services for interventional cardiovascular training include cardiac surgery, anesthesia, vascular and interventional radiology, vascular surgery, vascular medicine, neurology, nephrology, and hematology.

### 3. TRAINING COMPONENTS

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#### 3.1. Didactic Program

For Level I and II training, all trainees must attend a weekly cardiac catheterization conference. This may be a combined medical/surgical conference. The conference must present hemodynamic and angiographic data that are discussed in context with history, physical examination, and noninvasive findings. Indications, complications, and management strategies should also be discussed. It is particularly important that the Level I and II curricula should focus on teaching hemodynamics, cardiovascular physiology, and the pathophysiology of the major cardiovascular disorders in addition to coronary and peripheral vascular pathoanatomy. In this role, it is important that the cardiac catheterization program establish a close liaison with other noninvasive diagnostic laboratories. The educational program should emphasize relationships between the findings provided by the different diagnostic modalities in order to create a clear picture of the physiology and pathophysiology of the various cardiovascular disorders. A regular patient safety or quality improvement conference, either as part of the cardiac catheterization conference or as a separate conference, is also required. Additionally, exposure to and participation in regular catheterization laboratory peer review conferences is strongly recommended to educate trainees in focused and functional practices in peer review using random case selection, anonymization, and concordance with guidelines.

#### 3.2. Clinical Experience

Level I and II training require exposure to the wide variety of cardiovascular disorders and clinical procedures. This experience is important to provide not only direct hands-on training, but also the requisite material for clinical conferences. In addition to becoming familiar with the many manifestations of coronary artery disease, all trainees should also acquire experience in the

hemodynamic assessment, evaluation, and management of patients with valvular, myocardial, peripheral vascular, and congenital heart disease.

### 3.3. Hands-On Experience

The nature of a trainee's participation in a given procedure will vary depending on the procedure's complexity and the trainee's experience level. Requisite participation in a procedure includes the following elements:

1. *Preprocedural evaluation to assess appropriateness and plan procedure strategy.* Before the procedure, it is expected that the trainee will review the patient's medical record and obtain a confirmatory history and physical examination, giving specific attention to factors known to increase the risk of the procedure, such as vascular disease, renal failure, history of contrast reaction, congestive heart failure, anemia, active infection, and conditions known to increase the risk of bleeding. The trainee should also obtain informed consent and document a preprocedural note that includes indications for the procedure, opportunities for the findings to influence the care of the patient, risks of the procedure, alternatives to the procedure, and understanding by the patient. This should be done and documented in conjunction with the supervising faculty member.
2. *Performance of the procedure by the trainee at a level appropriate to experience, always (at all levels) under the direct supervision of a program faculty member.* Level I trainees will begin in a mostly observational role and assume greater participation as experience is gained. Level II trainees will assume progressive responsibility for conducting diagnostic procedures and coordinating the various functions of ancillary staff in the room (e.g., directing nurses, hemodynamic technicians, and junior fellows) as they acquire skills. Highly experienced Level II (or Level III) trainees may collaborate in a procedure with Level I trainees under the direct supervision of a program faculty member. In this circumstance, both Level I and II (or Level III) trainees may claim credit for participation in the procedure.
3. *Participation in analyzing the hemodynamic and angiographic data obtained during the procedure and preparation of the procedure report as well as formulation of treatment plans and relevant communication back to the referring doctors.* Trainees should participate in the creation of the procedure report, including drawing appropriate conclusions and making recommendations to ordering physicians and care teams. Procedure results should be communicated to care teams clearly and concisely by the fellow and/or supervising physician.

4. *Active involvement in pre- and postprocedural management inside and outside of the catheterization laboratory.* After the procedure, a note should be placed in the medical record. The trainee should monitor the patient and be available to respond to adverse reactions or complications that may arise, such as hypotension, vascular complications, bleeding, heart failure, renal failure, or myocardial ischemia. A final report should be completed within the time frame stipulated by local institutional policy and regulatory standards. If a complication occurs, the trainee should participate in the follow-up and management of the complication.

## 4. SUMMARY OF TRAINING REQUIREMENTS

### 4.1. Development and Evaluation of Core Competencies

Training and requirements in invasive cardiology address the 6 general competencies promulgated by the ACGME/ABMS and endorsed by the ABIM. These competency domains are: medical knowledge, patient care and procedural skills, systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills. The ACC has used this structure to define and depict the components of the core clinical competencies for cardiology. The curricular milestones for each competency and domain also provide a developmental roadmap for fellows as they progress through various levels of training and serve as an underpinning for the ACGME/ABIM reporting milestones. The ACC has adopted this format for its competency and training statements, career milestones, lifelong learning, and educational programs. Additionally, it has developed tools to assist physicians in assessing, enhancing, and documenting these competencies.

**Table 1** delineates each of the 6 general competency domains, as well as their associated curricular milestones for training in invasive cardiology. The milestones are categorized into Level I, II, and III training (as previously defined in this document), and indicate the stage of fellowship training (12, 24, or 36 months, and additional time points) by which the typical cardiovascular trainee should achieve the designated level. Given that programs may vary with respect to the sequence of clinical experiences provided to trainees, the milestones at which various competencies are reached may also vary. Level I competencies may be achieved at earlier or later time points. Acquisition of Level II skills requires additional training, and Level III skills require training in a dedicated interventional cardiovascular program. The table also describes examples of evaluation tools suitable for assessment of competence in each domain.

**TABLE 1 Core Competency Components and Curricular Milestones for Training in Invasive Cardiology**

Competency Component		Milestones (Months)			
MEDICAL KNOWLEDGE		12	24	36	Add
1	Know the indications/contraindications and potential complications of cardiac catheterization for assessment of coronary, valvular, myocardial, and basic adult congenital heart diseases.		I		
2	Know the principles of radiation safety.		I		
3	Know the use and complications of contrast media and the role of renal protection measures.		I		
4	Know the indications for, and clinical pharmacology of, antiplatelet and anticoagulant drugs and vasopressor and vasodilator agents used in the cardiac catheterization laboratory.		I		
5	Know normal cardiovascular hemodynamics and the principles and interpretation of waveforms, pressure, flow, resistance, and cardiac output measurements.		I		
6	Know the characteristic hemodynamic findings with myocardial, valvular, pericardial, and pulmonary vascular diseases.		I		
7	Know the methods to detect and estimate the magnitude of intracardiac and extracardiac shunts.		I		
8	Know coronary anatomy, its variations and congenital abnormalities, and its coronary blood flow physiology.		I		
9	Know the angiographic features of coronary artery disease and how to assess the anatomic and physiologic severity.		I		
10	Know the vascular anatomy and the indications and contraindications for, and complications of, peripheral vascular angiography.		I		
11	Know the indications and potential complications of percutaneous coronary, peripheral, valvular, and structural heart interventions.		I		
12	Know the indications and contraindications for, and the complications of, endomyocardial biopsy and pericardiocentesis.		I		
13	Know the indications for, and the mechanisms of action of, mechanical circulatory support devices.		I		
14	Know the indications for, and complications of, vascular access and closure strategies and devices.		I		
<b>EVALUATION TOOLS:</b> conference presentation, direct observation, in-training examination, logbook, and simulation.					
PATIENT CARE AND PROCEDURAL SKILLS		12	24	36	Add
1	Skill to perform preprocedural evaluation, assess appropriateness, obtain informed consent, and plan procedure strategy.		I		
2	Skill to perform venous and arterial access and obtain hemostasis.		I		
3	Skill to perform right heart catheterization.		I		
4	Skill to analyze hemodynamic, ventriculographic, and angiographic data and to integrate with clinical findings for patient management.		I		
5	Skill to manage postprocedural patients, including complications and coordination of care.		I		
6	Skill to perform endomyocardial biopsy.			II	
7	Skill to perform pericardiocentesis.			II	
8	Skill to perform diagnostic left heart catheterization, ventriculography, and coronary angiography.			II	
9	Skill to place an intra-aortic balloon pump emergently.			II	
10	Skill to perform diagnostic peripheral (excluding carotid) angiography.			II	
11	Skill to perform percutaneous coronary interventions.				III
12	Skill to perform peripheral, carotid, valvular, and structural heart interventions.				III
13	Skill to insert and manage percutaneous left ventricular support devices.				III
<b>EVALUATION TOOLS:</b> chart-stimulated recall, conference presentation, direct observation, logbook, and simulation.					
SYSTEMS-BASED PRACTICE		12	24	36	Add
1	Coordinate care in an interdisciplinary approach for patient management, including transition of care.		I		
2	Utilize cost-awareness and risk/benefit analysis in patient care.		I		
<b>EVALUATION TOOLS:</b> chart-stimulated recall, conference presentation, direct observation, and logbook.					

**TABLE 1 Core Competency Components, continued**

Competency Component		Milestones (Months)			
PRACTICE-BASED LEARNING AND IMPROVEMENT		12	24	36	Add
1	Locate, appraise, and assimilate information from scientific studies, guidelines, and registries in order to identify knowledge and performance gaps.		I		
2	Document number and outcomes of diagnostic and therapeutic procedures.		I		
EVALUATION TOOLS: conference presentation, direct observation, logbook, and reflection and self-assessment.					
PROFESSIONALISM		12	24	36	Add
1	Practice within the scope of expertise and technical skills.		I		
2	Know and promote adherence to guidelines and appropriate use criteria.		I		
3	Interact respectfully with patients, families, and all members of the healthcare team, including ancillary and support staff.	I			
EVALUATION TOOLS: conference presentation, direct observation, multisource evaluation, and reflection and self-assessment.					
INTERPERSONAL AND COMMUNICATION SKILLS		12	24	36	Add
1	Communicate with and educate patients and families across a broad range of socioeconomic, ethnic, and cultural backgrounds, including obtaining informed consent.		I		
2	Communicate and work effectively with physicians and other professionals on the healthcare team regarding procedure findings, treatment plans, and follow-up care coordination.		I		
3	Complete procedure records and communicate testing results to physicians and patients in an effective and timely manner.		I		
EVALUATION TOOLS: direct observation and multisource evaluation.					

Add = additional months beyond the 3-year cardiovascular fellowship.

#### 4.2. Structure and Duration of Training

The specific competencies for Levels I, II, and III are delineated in [Table 1](#). Level I competencies must be obtained by all fellows during the cardiovascular disease fellowship training program. Level II competencies may be obtained during the cardiovascular disease fellowship by selected fellows depending on their career focus and elective experiences. Level III competencies are noted so that fellows are aware of the competencies for which additional, advanced training beyond the standard 3-year fellowship is required. A brief discussion of the competencies and training requirements for Levels I, II, and III follow. Although the training duration and numbers of procedures are typically required to obtain competency, trainees must also demonstrate achievement of the competencies as assessed by the outcomes evaluation measures.

##### 4.2.1. Level I Training Requirements

Level I training requires approximately 4 months of experience in the cardiac catheterization laboratory. During this period, a trainee should generally participate in a minimum of 100 diagnostic cardiac catheterization procedures. At least 50 of these procedures should involve coronary angiography, and 25 should involve hemodynamic assessment of valvular, myocardial, pericardial, or

congenital disease. Only 1 Level I trainee may claim credit for participation in a given procedure; however, a Level I and a Level II (or III) trainee may claim credit for the same procedure if they perform different functions, applicable to their training levels and expertise. An essential part of Level I training is instruction in evaluating hemodynamic data and reading cardiac and coronary angiographic studies.

##### 4.2.2. Level II Training Requirements

Level II training generally requires a total of approximately 6 months in the cardiac catheterization laboratory and participation in the performance (under direct supervision) of approximately 300 diagnostic cardiac catheterization procedures. For competency in peripheral vascular angiography, the typical candidate should participate in the performance (under direct supervision) of approximately 100 invasive diagnostic peripheral vascular (not carotid) angiographic procedures. This competency may not be acquired by all Level II trainees and is further addressed in the COCATS 4 Task Force 9 report. Only 1 Level II trainee may claim credit for participation in a given diagnostic procedure. A Level II trainee may claim 1 cardiac procedure and 1 peripheral vascular diagnostic procedure for the same patient when appropriate.

### 4.2.3. Level III Training Requirements

Level III training must be performed during additional year(s) of fellowship dedicated to cardiovascular interventional training (2). Level II training in vascular medicine (COCATS 4 Task Force 9 report) is suggested prior to or in conjunction with training in catheter-based peripheral vascular intervention. Level III training leads to the ability to direct a cardiac catheterization laboratory, train others, and conduct advanced research in interventional cardiology.

## 5. EVALUATION OF COMPETENCY

Evaluation tools in cardiac catheterization include direct observation by instructors, in-training examinations, case logbooks, conference and case presentations, multisource evaluations, trainee portfolios, simulation, and reflection and self-assessment. Case management, judgment, interpretive, and bedside skills must be evaluated in every trainee. Quality of care and follow-up; reliability; judgment, decisions, or actions that result in complications; interaction with other physicians, patients, and laboratory support staff; initiative; and the ability to make appropriate decisions independently should be

considered. Trainees should maintain records of participation and advancement in the form of a Health Insurance Portability and Accountability Act (HIPAA)-compliant electronic database or logbook that meets ACGME/ABIM reporting standards and summarizes pertinent clinical information (e.g., number of cases, diversity of referral sources, diagnoses, disease severity, outcomes, and disposition).

The ACC, AHA, and SCAI have formulated a clinical competence statement on invasive and interventional cardiovascular procedures (5). Self-assessment programs and competence examinations are available through the ACC and other organizations. Training directors and trainees are encouraged to incorporate these resources in the course of training.

The faculty, under the aegis of the program director, should record and verify each trainee's experiences, assess performance, and document satisfactory achievement. The program director is responsible for confirming experience and competence and for reviewing the overall progress of individual trainees with the Clinical Competence Committee to ensure achievement of selected training milestones and to identify areas in which additional focused training may be required.

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**KEY WORDS** ACC Training Statement, cardiac catheterization, clinical competence, COCATS, fellowship training



**APPENDIX 1. AUTHOR RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—  
COCATS 4 TASK FORCE 10: TRAINING IN CARDIAC CATHETERIZATION**

<b>Committee Member</b>	<b>Employment</b>	<b>Consultant</b>	<b>Speakers Bureau</b>	<b>Ownership/ Partnership/ Principal</b>	<b>Personal Research</b>	<b>Institutional/ Organizational or Other Financial Benefit</b>	<b>Expert Witness</b>
Spencer B. King III ( <i>Chair</i> )	Saint Joseph's Heart and Vascular Institute—Professor of Medicine (Emeritus), Emory University	None	None	None	None	None	None
Joseph D. Babb	East Carolina University Cardiovascular Sciences—Professor of Medicine	None	None	None	None	None	None
Eric R. Bates	University of Michigan Hospitals and Health Centers—Professor of Medicine	None	None	None	None	None	None
Michael H. Crawford	University of California San Francisco Medical Center—Professor of Medicine, Chief of Clinical Cardiology	None	None	None	None	None	None
George D. Dangas	Mount Sinai Medical Center—Program Director, Interventional Cardiology	None	None	None	None	None	None
Michele D. Voeltz	Henry Ford Hospital—Director, Interventional Cardiology Fellowship Training Program	None	None	None	None	None	None
Christopher J. White	The Ochsner Clinical School, University of Queensland—Professor and Chairman of Medicine	None	None	None	None	None	None

For the purpose of developing a general cardiology training statement, the ACC determined that no relationships with industry or other entities were relevant. This table reflects authors' employment and reporting categories. To ensure complete transparency, authors' comprehensive healthcare-related disclosure information—including relationships with industry not pertinent to this document—is available in an [online data supplement](#). Please refer to <http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/relationships-with-industry-policy> for definitions of disclosure categories, relevance, or additional information about the ACC Disclosure Policy for Writing Committees.

ACC = American College of Cardiology.

**APPENDIX 2. PEER REVIEWER RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—  
COCATS 4 TASK FORCE 10: TRAINING IN CARDIAC CATHETERIZATION**

Name	Employment	Representation	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional/ Organizational or Other Financial Benefit	Expert Witness
Richard Kovacs	Indiana University, Krannert Institute of Cardiology—Q.E. and Sally Russell Professor of Cardiology	Official Reviewer, ACC Board of Trustees	None	None	None	None	None	None
Dhanunjaya Lakkireddy	Kansas University Cardiovascular Research Institute	Official Reviewer, ACC Board of Governors	None	None	None	None	None	None
Howard Weitz	Thomas Jefferson University Hospital—Director, Division of Cardiology; Sidney Kimmel Medical College at Thomas Jefferson University—Professor of Medicine	Official Reviewer, Competency Management Committee Lead Reviewer	None	None	None	None	None	None
J. Dawn Abbott	Warren Alpert Medical School of Brown University—Director, Interventional Cardiology Fellowship; Associate Professor of Medicine	Organizational Reviewer, SCAI	None	None	None	None	None	None
Michael Ragosta	University of Virginia Health System—Cardiovascular Division	Organizational Reviewer, SCAI	None	None	None	None	None	None
Brian D. Hoit	University Hospitals Case Medical Center	Content Reviewer, Cardiology Training and Workforce Committee	None	None	None	None	None	None
Larry Jacobs	Lehigh Valley Health Network, Division of Cardiology; University of South Florida—Professor, Cardiology	Content Reviewer, Cardiology Training and Workforce Committee	None	None	None	None	None	None
Andrew Kates	Washington University School of Medicine	Content Reviewer, Academic Cardiology Section Leadership Council	None	None	None	None	None	None
Lloyd W. Klein	Rush University	Content Reviewer, Interventional Section Leadership Council	None	None	None	None	None	None
Robert Piana	Vanderbilt University Medical Center—Professor, Medicine, Cardiology	Content Reviewer, Interventional Section Leadership Council	None	None	None	None	None	None
Tanveer Rab	Emory University School of Medicine—Associate Professor, Medicine, Cardiology/ Interventional Cardiology	Content Reviewer, Interventional Section Leadership Council	None	None	None	None	None	None

For the purpose of developing a general cardiology training statement, the ACC determined that no relationships with industry or other entities were relevant. This table reflects peer reviewers' employment, representation in the review process, as well as reporting categories. Names are listed in alphabetical order within each category of review. Please refer to <http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/relationships-with-industry-policy> for definitions of disclosure categories, relevance, or additional information about the ACC Disclosure Policy for Writing Committees.

ACC = American College of Cardiology; SCAI = Society for Cardiovascular Angiography and Interventions.

**APPENDIX 3. ABBREVIATION LIST**

ABIM = American Board of Internal Medicine

ABMS = American Board of Medical Specialties

ACC = American College of Cardiology

ACGME = Accreditation Council for Graduate Medical Education

AHA = American Heart Association

COCATS = Core Cardiovascular Training Statement

HIPAA = Health Insurance Portability and Accountability Act

SCAI = Society for Cardiovascular Angiography and Interventions