

ACC TRAINING STATEMENT

American College of Cardiology Training Statement on Recommendations for the Structure of an Optimal Adult Interventional Cardiology Training Program

A Report of the American College of Cardiology
Task Force on Clinical Expert Consensus Documents

*Endorsed by the Society for Cardiac Angiography and Interventions and the Diagnostic and Interventional Catheterization
Committee on the Council on Clinical Cardiology, American Heart Association*

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I. BACKGROUND

Twenty-two years have elapsed since Andreas Gruentzig, MD, performed the first coronary angioplasty (1,2). During that period, coronary angioplasty and its related procedures have evolved into a highly specialized cognitive and technical discipline, and the expectation of quality in coronary interventional procedure outcome is continually rising (3). These developments are reflected by the American Board of Internal Medicine's decision to offer an Added Qualification Examination in Interventional Cardiology beginning in 1999 (4).

Concurrently, training in interventional cardiology has evolved from the early "on the job" experience to the development of formal training programs. However, although formal interventional cardiology training programs are now accepted, until recently, there were no uniform standards for programmatic organizational structure or curriculum. As a response to the need for standards, the Residency Review Committee of the American Council on Graduate Medical Education (ACGME) developed a formal accrediting process, effective in September of 1998 (5), for interventional cardiology training programs. The training program standards developed by the ACGME constitute a threshold standard of quality that all training programs must meet in order to be accredited.

The mission of the American College of Cardiology (ACC) is to foster optimal cardiovascular care through professional education, disease prevention and the promotion of professional standards. Consequently, the College has a responsibility to address the issue of standards for the development and maintenance of competence in coronary interventional procedures. The College has published several such statements previously (6-9). Recently it published an updated statement on recommendations for the maintenance of competence (10).

This document updates and extends the College's earlier recommendations for optimal training in interventional cardiology. In addition to endorsing the ACGME standards for program accreditation, it makes recommendations for enhancements beyond those standards, which would further strengthen and improve a program's educational and training environment. Thus, this document's purpose is to identify both the minimum and optimal characteristics of an interventional cardiology training program. The dis-

inction between minimum and optimal does not imply that there is any published data to indicate that trainees from programs that met only the minimum standards are either inadequately trained or now perform in a suboptimal manner.

Table 1 provides a synopsis of the basic elements of the ACGME standards and criteria for accreditation of an interventional cardiology training program. Where appropriate, the table also lists ACC recommendations for programmatic enhancements.

This document is divided into four sections:

- **Training Program Goals and Structure:** This addresses the program goals and requirements for faculty, facilities and patient population.
- **Training Program Didactic Curriculum:** This addresses the requirements for didactic educational curriculum and conferences.
- **Duration and Conduct of Training:** This addresses the process for procedure training, including numeric standards, the types of procedures included, the standards for structured conferences and trainee participation in research.
- **Trainee Evaluation:** This addresses the conduct of the trainee evaluation process.

II. TRAINING PROGRAM GOALS AND STRUCTURE

A. Goals

The purpose of an interventional cardiology training program is to prepare its trainees to function at a high level of clinical performance in interventional cardiology. This includes the development of appropriate clinical judgment in selecting patients for cardiac interventional procedures and a high level of technical skill in performing them. This overall goal has four components:

1. To understand the effectiveness and limitations of coronary interventional procedures in order to select patients and procedure types appropriately.
2. To achieve the appropriate cognitive knowledge and technical skills needed to perform interventional cardiac procedures at the level of quality attainable through the present state of the art.
3. To foster an attitude of life-long learning and critical thinking skills needed to gain from experience and incorporate new developments.
4. To understand and commit to quality assessment and improvement in procedure performance.

B. Academic Relationships

A training program in interventional cardiology should not operate in isolation. Interventional cardiology is one of a number of therapeutic techniques applicable to the management of coronary artery and valvular disease. Thus, its application must be selected within the context of all potential cardiovascular therapeutic strategies and must

Table 1. Standards for Training in Interventional Cardiology

	ACGME Minimal Core Requirements	ACC Additional Recommendations for Optimal Program
Educational Program		
Programmatic relationships	Integral component of an accredited subspecialty residency in cardiovascular disease	
Training prerequisites	Completion of accredited three-year cardiology training program	Trainee must achieve COCATS level II competence in diagnostic catheterization
Training duration	One year	
Faculty		
General qualifications	<ul style="list-style-type: none"> • 2 key clinical faculty (>75 annual volume) • No more than 1.5 trainees per faculty member • Board-certified in interventional cardiology 	<ul style="list-style-type: none"> • 3 key clinical faculty (more recommended) • Board-certified in interventional cardiology • >125 annual procedure volume • >500 procedure career experience • Board-certified in interventional cardiology • >1000 career procedure experience • Not all skills need to be represented in each faculty member • Cardiac valvuloplasty expertise desirable but not mandatory
Program Director		
Expertise	<ul style="list-style-type: none"> • Balloon angioplasty • Coronary stents • Coronary atherectomy • Intravascular ultrasound • Coronary Doppler and pressure measurement 	
Facilities and Resources		
Equipment	One appropriately equipped cardiac catheterization laboratory	Cardiac catheterization laboratory must have digital video processing with roadmapping and gap-fill
Activity level	400 procedures per year	<ul style="list-style-type: none"> • >600 is optimal • >100 diagnostic catheterizations per year for intrinsic cardiac valve disease
Coexisting facilities	<ul style="list-style-type: none"> • Cardiac care unit • On-site cardiac surgery • Cardiac surgical intensive care unit • Outpatient cardiac care program 	<ul style="list-style-type: none"> • On-site cardiac ultrasound • On-site cardiac nuclear medicine • On-site clinical electrophysiology
Program Content		
Clinical experience (evaluation, management)	<ul style="list-style-type: none"> • Clinical experience with chronic and acute ischemic heart disease and with valvular disease • Bleeding complications • Care of patients pre- and postinterventional procedures • Cognitive knowledge base of clinical decision-making • Outpatient follow-up of patients who have undergone interventional procedures 	
Technical and other skills	<ul style="list-style-type: none"> • Cardiovascular pharmacology and other adjunctive therapeutic skills • Interpretation of diagnostic hemodynamics, angiography, intravascular ultrasound and Doppler • >250 coronary interventional procedures performed • Participation in a case includes: preprocedural evaluation, performing the critical manipulations of the procedure and being actively involved in postprocedure management 	<ul style="list-style-type: none"> • 250 procedures during training is a bare minimum; at least 400 is optimal. • Core skills include conventional balloon angioplasty, coronary stents, coronary atherectomy, primary angioplasty for acute myocardial infarction, intravascular ultrasound, intra-aortic balloon counterpulsation and other mechanical circulatory support. • Optional skills include cardiac valvuloplasty, endomyocardial biopsy, Doppler coronary flow measurement and transcatheter closure of congenital cardiac defects.

utilize information from all available cardiovascular diagnostic techniques. Consequently, an interventional cardiology training program must be integrally affiliated with, and a component of, a comprehensive ACGME accredited cardiology training program.

C. Faculty

A high-quality training program requires a full-time, fully affiliated faculty with the expertise and commitment required to provide an optimal educational and training experience. The minimum faculty complement specified by the ACGME is two, with the additional proviso that a program should have no more than 1.5 trainees per faculty member.

Exposure to a greater number of faculty substantially enhances the quality of an interventional cardiology training experience. Individual faculty members will vary both in their skills and in their strategic approaches to patient selection and procedure conduct. A larger program will provide a greater number of skilled, experienced mentors for its trainees. Consequently, larger programs should be encouraged. An optimal program should have a minimum of three key faculty, with a key faculty/trainee ratio of 0.5 trainees per faculty member and with each key faculty member devoting at least 20 h per week to the program.

The faculty should consist of a Program Director and other associated faculty.

1. Program Director. The Program Director is responsible for the program's overall direction. This includes policy development, program operation, trainee and other faculty supervision, and trainee evaluation. The Program Director should be a fully affiliated faculty member of the cardiology training program's parent institution. The program director must be board-certified in interventional cardiology and should have a career experience of at least five years after the completion of training, including an aggregate experience of 1,000 coronary interventional procedures.

2. Other key program faculty. The other key program faculty are also responsible for contributing to the program's teaching and training activities. They should be faculty of the cardiology training program's parent institution and should be board-certified in interventional cardiology. A faculty member should have a career experience of at least 500 coronary interventional procedures. It is recognized that new faculty may join a program immediately after completion of training, at which time they will not yet satisfy the career experience standard. Such individuals should satisfy that standard and achieve board certification as soon as possible.

3. Faculty clinical procedure volume. The ACGME specifies that program faculty should maintain an activity level of at least 75 coronary interventional procedures per year. This activity level is recognized by the ACC as a threshold level for maintenance of competence, but it is to

be considered a low activity level for individuals who have training responsibilities. Abundant clinical data indicate that, although basic expertise may be maintained at an experience level of 75 procedures per year, operators who have greater activity levels achieve the better outcomes (11,12). Consequently, the ACC recommends that program faculty achieve a minimum clinical activity level of 125 procedures per year and encourages higher levels.

4. Faculty expertise. The components of the core training experience are listed in Section IV, Duration and Conduct of Training. A comprehensive training program should offer training in each of the specified techniques. Subspecialization within interventional cardiology is common. Consequently, not all faculty need to have expertise with all interventional techniques and devices. However, the program's overall faculty complement should include expertise in each of those techniques.

D. Facilities and Environment

1. General facilities. An interventional cardiology training program must be an integral component of a comprehensive cardiovascular disease training program. On-site capabilities must include cardiovascular critical care, cardiac surgery, cardiac ultrasound, nuclear cardiology and clinical electrophysiology.

2. Cardiac catheterization laboratory. The facility must include at least one fully equipped cardiac catheterization laboratory. In order to meet the clinical activity standards, most facilities will necessarily require more than one procedure room. The minimal X-ray equipment complement consists of a single-plane cineradiographic unit. The unit must have digital video image processing capability that includes cine gap-fill, contrast and edge enhancement and image roadmapping.

3. Patient mix. A trainee in interventional cardiology should be exposed to the full spectrum of cardiac ischemic syndromes. These include, but are not limited to, stable angina and a variety of acute cardiac ischemic syndromes such as unstable angina, acute myocardial infarction and cardiogenic shock. The trainee's experience should include both interventions in native coronary arteries and surgically placed coronary bypass grafts. The trainee must also acquire significant experience in the management of patients who require circulatory support, particularly with intra-aortic balloon counterpulsation.

4. Program procedure volume. In order to provide a comprehensive experience for its trainees, a program must perform a requisite number of coronary interventional procedures per year. This threshold number is required to enable trainees to participate in caring for the full spectrum of cardiac patients. It is important that trainees acquire requisite experience with the full range of clinical presentations and anatomic and pathologic characteristics of the disorders treated by interventional cardiology techniques. In

addition, a requisite amount of case material is needed to support periodic clinical conferences and case discussions and to enable the program faculty to have sufficient clinical experience to maintain and further develop their skills. It is important that the program have an active program of direct angioplasty for acute myocardial infarction in order that trainees gain experience in this category of coronary interventional procedures.

The ACGME specifies that a program perform a minimum of 400 coronary interventional procedures per year. This should be considered an absolute minimum. The complexity of interventional cardiology, the variety of circumstances encountered and the number of different interventional devices in active clinical use demand that a trainee be exposed (either directly through performing procedures or indirectly through conference reviews of cases) to as large a number of procedures as possible. The ACC recommends that training programs perform at least 600 procedures per year.

It is important that trainees be experienced not only in caring for patients with coronary artery disease, but also in the evaluation and treatment of intrinsic valvular disease. Cardiac valvuloplasty is an important, relatively infrequently performed procedure—but not a core technique. Valvuloplasty is rarely emergent and thus should be regionalized. Not all interventional cardiologists need master it, and accordingly, not all interventional cardiology training programs need offer training in it. However, an interventional cardiologist must understand the hemodynamics and pathophysiology of valvular disease as well as the efficacy of, and the selection criteria for, cardiac valvuloplasty procedures. In order to provide this experience, a program should perform diagnostic catheterizations on at least 100 patients per year with intrinsic valvular heart disease.

III. TRAINING PROGRAM DIDACTIC CURRICULUM

A body of basic information underpins the practice of interventional cardiology. Understanding it is integral to determining procedure appropriateness, case selection, technique selection, procedure conduct, and adjunctive therapy selection. Consequently, training solely in the technical aspects of performing procedures is inadequate. A training program must ensure that its trainees acquire the requisite cognitive knowledge base.

A synopsis of the important topics basic to interventional cardiology appears below:

Anatomy: Cardiac, vascular and coronary artery anatomy, including anatomic variants and congenital abnormalities.

Physiology: Basic circulatory physiology, coronary vascular physiology, myocardial blood flow regulation, myocardial physiology and metabolism.

Vascular biology and pathology: Normal vascular structure and function, response to injury, mechanisms of atherosclerosis and mechanisms of restenosis.

Hemostasis: Intrinsic and extrinsic coagulation cascade and platelet physiology.

Pathophysiology: Myocardial ischemia and infarction, myocardial reperfusion, circulatory shock, anaphylaxis and cardiac arrhythmias.

Pharmacology: Anticoagulants, antiplatelet drugs, thrombolytic drugs, X-ray contrast agents, myocardial inotropes, vasopressors, vasodilators, antiarrhythmic drugs and drugs affecting lipid metabolism.

Radiology imaging and radiation safety: Principles of X-ray imaging, quantitative coronary arteriography, operation of cinefluorographic X-ray equipment, operation of digital video imaging systems, radiation biology and radiation protection.

Intracoronary imaging and coronary physiology: Principles of intravascular ultrasound imaging and Doppler coronary flow velocity measurements.

Interventional device design and performance: Device materials and characteristics.

Clinical management strategies: Performance and limitations of interventional devices, spectrum of coronary ischemic syndromes, results of interventional cardiology clinical trials, management of acute hemodynamic alterations and mechanical and pharmacological circulatory support.

This cognitive knowledge base is also linked to the technical aspects of performing procedures. For example, the understanding of specific details of coronary anatomy, such as the relationship of the coronary ostia to the sinuses of Valsalva and the three-dimensional arrangement of coronary anatomy, is essential to technique, instrument selection and procedure execution.

A training program must have a strategy to ensure that trainees receive a comprehensive didactic education as outlined in the preceding synopsis. This can be accomplished through either a program of supervised study or the didactic seminars and conferences discussed in Section IV-D.

IV. DURATION AND CONDUCT OF TRAINING

A. Core Procedure Capability

A comprehensive training program should offer a core experience in the following interventional techniques:

1. Conventional balloon coronary angioplasty,
2. Coronary artery stents,
3. Primary angioplasty for acute myocardial infarction,
4. Atherectomy techniques (other than laser),
5. Intravascular ultrasound, and

6. Intra-aortic balloon counterpulsation and other techniques of mechanical circulatory support.

Other techniques not included in this list are optional, depending on the expertise and practice patterns of the institution.

These may include:

1. Cardiac valvuloplasty,
2. Endomyocardial biopsy,
3. Coronary flow measurement (including fractional flow reserve),
4. Transcatheter closure of congenital defects, and
5. Laser atherectomy techniques.

Trainees should be experienced in the full range of arterial vascular access techniques. These should include both transfemoral approaches and approaches from the arm.

Coronary interventional procedure experience should include the full range of coronary interventional activity. Thus, a trainee should have experience treating the full range of coronary lesion morphologic subsets. This includes type A, B and C lesions; total occlusions; heavily calcified lesions; saphenous vein graft lesions; and lesions accessed via arterial bypass grafts.

B. Prerequisites to Interventional Training

Before undertaking training in interventional cardiology, a trainee must achieve competence in general cardiology and in diagnostic cardiac catheterization. This may be defined as achieving the Level I and II skills described in the American College of Cardiology's Core Cardiology Training Symposium (COCATS) (9). This requires completion, over a period of three years, of a two-year comprehensive core training in general cardiology. This training should include a total of 12 months of training devoted to diagnostic cardiac catheterization. This experience is more comprehensive than the basic four-month experience for non-invasive cardiologists. During the third year, a trainee should perform 300 diagnostic procedures, including 200 with "primary responsibilities."

C. Duration and Conduct of Interventional Procedure Training

Training in coronary interventional procedures must be carried out during a fourth year of fellowship dedicated predominantly to coronary interventional training. Preceptorships and on-the-job training are no longer recognized as viable methods of training. During this period, the trainee should be focused predominantly on diagnostic and interventional cardiology procedures.

The ACGME specifies that the trainee must participate in a minimum of 250 coronary interventional cases during this period. The ACGME defines a "coronary interventional case" as all coronary interventional procedures performed during a single hospitalization. Thus, staged procedures or emergent repeat procedures are counted as a single

case. This experience level should be considered a threshold value to achieve comprehensive training according to current standards. The ACC recommends that, when possible, trainees perform more than the threshold number of 250 procedures during training. On the other hand, more is not necessarily better, and participating in too many procedures can degrade the training experience. Consequently, the ACC recommends that trainees participate in a maximum of 600 procedures per year.

To derive optimal educational benefit from participation in a case, the trainee must take a comprehensive and active role in both its cognitive and technical aspects. Thus, the requisite participation to permit a trainee to achieve appropriate experience should include the following elements:

1. Preprocedural evaluation to assess appropriateness and to plan procedure strategy.
2. Personal performance by the trainee of the case's critical manipulations under the direct supervision of a program faculty member. The faculty member who takes overall responsibility for the case must be immediately available to supervise the trainee's actions and to take over the performance of the case any time it is in the patient's best interest.
3. Active involvement in postprocedural management both in the catheterization laboratory at the conclusion of the case and on the inpatient unit afterward. This includes assessing for possible adverse outcomes, managing vascular access sites and managing anticoagulation issues.

The nature of a trainee's participation in a given case will vary depending on the procedure's complexity and the trainee's experience. A program's training strategy should provide that the trainee's responsibility and involvement in a case's technical manipulations progressively increase as experience is gained. The trainee should also be involved in procedure reporting and the process of ensuring quality.

D. Clinical Conferences

The interventional cardiology training program should conduct a regularly scheduled clinical interventional cardiology conference. Ideally this conference should be held weekly. It should have two purposes:

1. Review and critique both diagnostic and interventional cases with respect to case selection, procedure conduct and outcome. This conference should review and discuss all adverse outcomes that occur within the training program.
2. Present and discuss the cognitive interventional cardiology curriculum subject matter (as listed in Section III).

In addition, the parent cardiology training program should operate a joint cardiology/cardiac surgery clinical conference at which a broad spectrum of clinical issues are discussed. Many topics discussed at such a conference will be relevant to interventional cardiology. The faculty and

trainees of the interventional cardiology program should have active involvement in this conference.

E. Trainee Participation in Research

Participation in clinical research by trainees is an integral component of achieving competence in this rapidly evolving field. Thus, the interventional cardiology training program should have an active clinical research program, and its trainees should be directly involved in the conduct of research. This may range from participation as a multicenter clinical trial-contributing site to locally initiated research in various facets of interventional cardiology.

Trainees should be actively involved in the conduct of and enrollment of patients in clinical trials. Ideally, trainees will also be active collaborators in locally initiated research protocols and will participate in data analysis and presentation.

V. TRAINEE EVALUATION

Evaluation of competence is an integral and crucial part of the didactic and "hands on" training of an interventional cardiologist. Responsibility for trainee evaluation resides with the program director, who is responsible for evaluating the trainee's progress in collaboration with the other program faculty. The overall evaluation includes rigorous compilation of trainee experience and assessment of the trainee's cognitive knowledge, technical skill and responsibility. Evaluative feedback, verbal and written, to the trainee during the training period is vital in directing the trainee's progress.

It is the responsibility of the interventional training program director, in conjunction with the director of the overall cardiology training program, to confirm and document the individual trainee's experience, competency, clinical judgment and thoroughness of training. The program director must maintain adequate records to document each trainee's experience in performing the various procedures required to satisfy the core training requirements. The training program should have a database system that records the trainee's caseload experience. The program director will use this system to validate the trainee's experience for the purpose of attesting to certifying boards and credentialing bodies.

Assessment of cognitive knowledge includes, in addition to the core cognitive knowledge base outlined in Section III, case selection, procedural judgment and interpretive skills. Evaluation of technical skills must be carried out by the direct supervision of the trainee during the performance of procedures. Evaluation of responsibility includes assessment of the thoroughness of preprocedural evaluation and clinical follow-up, reliability, and interpersonal interaction with patients, other physicians and laboratory staff.

During training, the program director should meet with the trainee periodically to provide structured evaluative

feedback on his/her progress. This should include identification of deficiencies and shortcomings and formulation of a plan for remediation.

The trainee is responsible for the maintenance of detailed records in the form of a logbook that contains clinical information for each patient studied and/or treated in the laboratory. Documentation must include a patient identifier, the procedure performed, assisting physicians and procedure outcomes, including any complications encountered.

The training program director is also responsible for attesting whether a trainee has achieved the requisite cognitive knowledge and has acquired the necessary technical skill to be recommended for privileges as an independent interventional operator. An important component of this evaluation is the program director's assessment of the maturity and sophistication of the trainee's clinical judgment both in the conduct of interventional procedures and in out-of-laboratory clinical case selection and decision-making.

REFERENCES

1. Gruentzig A. Transluminal dilatation of coronary-artery stenosis. *Lancet* 1978;1:263.
2. Gruentzig AR, Senning A, Siegenthaler WE. Nonoperative dilatation of coronary-artery stenosis: percutaneous transluminal coronary angioplasty. *N Engl J Med* 1979;301:61-8.
3. Williams DO, Detre K, Yeh W, et al. The NHLBI Dynamic Registry for Coronary Intervention: Initial Results and Comparison to the 1985-86 Registry. *N Engl J Med* 1999. In Press.
4. American Board of Internal Medicine. Certification in Interventional Cardiology (Brochure). 1999; Philadelphia, PA.
5. Program Requirements for Residency Education in Interventional Cardiology. 1998; Accreditation Council for Graduate Medical Education. Anonymous Available at: www.acgme.org/reqs/IM-IC998. HTM. Effective September, 1998.
6. Conti CR, Faxon DP, Gruentzig A, et al. 17th Bethesda Conference: Adult Cardiology Training. Task Force III. Training in cardiac catheterization. *J Am Coll Cardiol* 1986;7:1205-6.
7. Ryan TJ, Klocke FJ, Reynolds W. Clinical competence in percutaneous transluminal coronary angioplasty. A statement for physicians from the ACP/ACC/AHA Task Force on Clinical Privileges in Cardiology. *Circulation* 1990;81:2041-6.
8. Douglas JSJ, Levin DC, Pepine CJ, et al. Recommendations for development and maintenance of competence in coronary interventional procedures. American College of Cardiology Cardiac Catheterization Committee. *J Am Coll Cardiol* 1993;22:629-31.
9. Pepine CJ, Babb JD, Brinker JA, et al. Guidelines for training in adult cardiovascular medicine. Core Cardiology Training Symposium (COCATS). Task Force 3: Training in Cardiac Catheterization and Interventional Cardiology. *J Am Coll Cardiol* 1995;25:14-6.
10. Hirshfeld JW, Ellis SG, Faxon DP. Recommendations for the Assessment and Maintenance of Proficiency in Coronary Interventional Procedures: Statement of the American College of Cardiology. *J Am Coll Cardiol* 1998;31:722-43.
11. Hannan EL, Racz M, Ryan TJ, et al. Coronary angioplasty volume-outcome relationships for hospitals and cardiologists. *JAMA* 1997; 277:892-8.
12. Jollis JG, Peterson ED, Nelson CL, et al. Relationship between physician and hospital coronary angioplasty volume and outcome in elderly patients. *Circulation* 1997;95:2485-91.