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TRAINING STATEMENT

COCATS 4 Task Force 14: Training in the Care of Adult Patients With Congenital Heart Disease

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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 included a cardiovascular training program director, a training director specializing in the care of adults with congenital heart disease (i.e., adult congenital heart disease [ACHD]), early-career ACHD cardiologists, 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 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 then addressed the reviewers' comments. The document was revised and posted for public comment from December 20, 2014, to January 6, 2015. Authors addressed these additional comments from the public to complete the document. The final document was approved by the Task Force and ACC Competency Management Committee and ratified by the ACC Board of Trustees in March, 2015. This document is considered current until the ACC Competency Management Committee revises or withdraws it.

1.2. Background and Scope

Remarkable advances in surgical management of congenital heart disease (CHD) over the last half century have allowed more than 90% of children with CHD to survive to adulthood (1). This has led to a shift in the prevalence of CHD, such that adults comprise two-thirds of the overall CHD population, with an estimated 1.5 million adult survivors in the United States alone. This population includes not only those with mild and moderate forms of CHD, but also, importantly, those with severe forms of CHD. Indeed, approximately 60% of those with severe CHD are now adults (2,3). The rise in incidence and prevalence is expected to continue, so healthcare delivery for CHD, including the training of cardiologists, must evolve as well to meet this demand. ACHD patients have special healthcare needs and often present complex combinations of problems that are generally unrecognized by those in a traditional, internal medicine-based cardiovascular training program (4). Adult cardiologists are experts in the care of acquired diseases that affect the heart and circulation, but currently most have little or no training in CHD, particularly in complex disorders. Exposure to ACHD patients and clinical experiences for cardiovascular fellows varies widely (3). Many ACHD patients continue to be cared

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for by pediatric cardiologists for many reasons, including the fact that there are few internal medicine cardiologists specializing in this complicated field and access is, therefore, limited (5,6). This report recommends an approach to more systematic training of internal medicine cardiologists in the recognition and care of ACHD patients on the basis of previous Bethesda Conference descriptions of workforce needs and educational requirements (5). Similar recommendations are made for ACHD training for pediatric cardiovascular trainees, with an emphasis on the importance of ACHD training for all cardiologists who may care for these patients, regardless of specialty (7). In addition, this report addresses 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 subdiscipline like ACHD. The Steering Committee and Task Force recognize that implementation of these changes in training requirements will occur incrementally over time.

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

- **Level I training** is the basic training required to become a competent cardiovascular consultant, is required of all cardiovascular fellows, and can be accomplished as part of a standard 3-year training program in cardiovascular medicine. This level of training should allow the trainee to develop sufficient knowledge to review and understand consensus-based ACHD care guidelines to determine which ACHD patients can be managed by a clinician and which patients are best cared for in collaboration with an ACHD specialist. Along with guideline-based care, this level of training should also enable the cardiologist to recognize when direct consultation and referral to an ACHD specialist are necessary. In some circumstances, Level I-trained physicians may participate in the care of patients with moderately or severely complex disease in close collaboration with an ACHD specialist.
- **Level II training** refers to the additional training in 1 or more areas that enables some cardiovascular specialists to perform or interpret specific diagnostic tests and 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 trainee's 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 to receive Level II training in a specific subspecialty. Recognizing the special needs of this complex patient population, the ABMS approved ACHD subspecialty certification in December 2012 (see specific criteria under Level III training). There is no Level II training curriculum or qualifying examination in ACHD. Thus, only Level I and III training apply to ACHD.
- **Level III training** requires additional training and experience beyond the cardiovascular fellowship for the trainee to acquire specialized knowledge and experience in performing, interpreting, and training others to perform specific procedures or render advanced specialized care for specific conditions at a high level of skill. In the case of ACHD, Level III training provides the knowledge needed by graduates wishing to make an advanced clinical and/or academic/research commitment to this field and to not only become competent in the care of the entire spectrum of ACHD patients, but also participate in teaching about ACHD (6). Level III competency requires specific time dedicated to training in pediatric cardiology (as outlined by the ACGME) for those with a background in adult cardiovascular medicine, and requires dedicated time in adult internal medicine and cardiology for those with a background in pediatric cardiology. Level III requires training beyond the 3 years of fellowship (in either pediatric or adult cardiovascular medicine). Such Level III training would be sufficient to clinically manage complex ACHD in a regional or tertiary center, pursue an academic career, train others in the field, and/or direct an ACHD program. ACHD subspecialty certification was approved through the ABMS in December 2012. The first examination in 2015 is available for those who qualify by meeting the practice pathway criteria and is administered by the ABIM in collaboration with the American Board of Pediatrics. Once the practice pathway closes, only those completing an ACGME-approved advanced ACHD fellowship (beyond adult or pediatric cardiovascular fellowship) will qualify for ACHD subspecialty certification. 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. The additional exposure and requirements for Level III training will be addressed in a subsequent, separately published Advanced Training Statement.

2. GENERAL STANDARDS

The ACC and American Heart Association have produced guidelines for ACHD (8) and educational objectives for

fellowship training in ACHD (9). 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 of added qualifications in ACHD, review the specific requirements of the ABIM. With recent ABMS approval for ACHD subspecialty certification, it is expected that the ACGME will standardize fellowship programs with specific guidelines for faculty, facilities, and curriculum, and that these guidelines will apply to advanced fellowship trainees with either pediatric or adult cardiovascular training.

2.1. Faculty

Ideally, to ensure adequate Level I training, a program should have at least 1 faculty member with expertise and commitment to the care of adults with CHD. This faculty member should have achieved the skills equivalent to Level III training by lifelong experience and/or specific training. In recognition that not all programs have ACHD expert faculty available, Level 1 training may be achieved without ACHD faculty on site, but in such cases other resources, such as online learning modules, visiting professors, "away" rotations, and print or electronic curricula, should be utilized. Affiliation with a pediatric cardiovascular program is an invaluable resource for congenital heart disease education. Advanced training (Level III) requires a critical mass of faculty dedicated to the care of adult patients with CHD and a program that provides comprehensive diagnostic and management services to patients with a broad array of congenital cardiac disorders. Affiliation with a pediatric cardiovascular program is ideal and will further ensure that the trainee in advanced ACHD is exposed to patients across the entire lifespan. This comprehensive ACHD education includes congenital interventional procedures; congenital electrophysiological consultation and procedures; congenital cardiac surgery; and training in ACHD echocardiography, computed tomography (CT), and magnetic resonance imaging (MRI). Organized, deliberate, and developmentally appropriate transition and transfer of patients from pediatric to ACHD programs are necessary, and comprehensive ACHD education should include participation in transition programs. Further training in intervention, electrophysiology, and in some cases, imaging, will be necessary for independent practice of these disciplines. Programs that have interdisciplinary involvement, including with obstetrics, pulmonary hypertension specialists, hematologists, hepatologists, and others, are forming a robust network of interdisciplinary clinicians with experience in caring for the entirety of the ACHD patient experience and are ideal in providing comprehensive training. This level of expertise may still be evolving at some institutions, but ACHD training should accord with ABIM- and ACGME-recommended guidelines.

2.2. Facilities, Equipment, Ancillary Support, and Program Requirements

To train cardiac fellows to achieve Level III competency, institutions that care for ACHD patients should meet certain program requirements and have essential ancillary support capabilities. Two basic requirements are indicated for a program to train fellows effectively at Level III: 1) the presence of associated formal programs in pediatric cardiology and cardiovascular CHD surgery; and 2) a critical mass of faculty who are board eligible/certified in ACHD. Relationships should also be cultivated in obstetrics, general surgery, cardiac anesthesia, hematology, hepatology, nephrology, and other subspecialties as feasible at a given institution. Because ACHD patients will use noncardiac hospital resources as well, appropriate monitoring should be available and specialty care should be coordinated with the ACHD team.

For comprehensive imaging assessment at a Level III training program, echocardiography laboratories with sonographers with training and expertise in assessing congenital heart lesions as well as echocardiographers who are expert in and experienced with reading ACHD echocardiograms must be available. Advanced imaging facilities, ACHD-specific MRI and CT protocols, and cardiologists or radiologists with experience in CHD are essential for comprehensive imaging at a Level III training program and, if available, should be leveraged for training and exposure at non-Level III programs.

At training institutions that perform adult congenital procedures, including but not limited to hemodynamic assessment and potential catheter-based or electrophysiological interventions, ancillary support is essential to ensure patient safety. This should include laboratories with fluoroscopy and specialized equipment for the safe performance of diagnostic procedures and congenital cardiac interventions or electrophysiological interventions in an adult. Institutions that intervene on ACHD patients must have cardiologists with the expertise to perform coronary interventions. The ability to perform detailed hemodynamic assessments, including the evaluation of pulmonary vascular disease and the reversibility of pulmonary hypertension, is also important. When available, a biplane room may benefit the ACHD patient. For institutions performing interventions on moderate-to-complex ACHD, cardiac anesthesia and a clear process for rapid availability of urgent or emergent cardiac surgery should be established. Operating rooms should be fully staffed and should have dedicated cardiac anesthesiologists and the resources necessary for ACHD operations as well as the capability for imaging and percutaneous interventions, as previously discussed.

3. TRAINING COMPONENTS

3.1. Didactic Program

Didactic instruction may take place in a variety of formats, including but not limited to lectures, conferences, journal clubs, grand rounds, clinical case presentations, and online learning. Such instruction can occur as a part of the fellow's core curriculum teaching or rotation-specific lectures, or may be incorporated into other subspecialty curricula such as electrophysiology, pulmonary hypertension, cardiac surgery, echocardiography, or noncardiac care (e.g., obstetrics, palliative care). Opportunities such as online learning from approved cardiac educational sites with continuing medical education credit should also be encouraged and included as supplements to hospital-based didactics. Whereas Level I competency can be achieved without an ACHD expert faculty member or substantial ACHD patient volume, Level III training requires both faculty expertise and patient volume that allow direct clinical care in addition to robust didactic education. A comprehensive curriculum is currently being developed by the ACC. Bedside physical examination, whether inpatient or outpatient, is an essential component of Level I training.

3.2. Clinical Experience

Rotation on an ACHD service is an essential component of all levels of ACHD training. For programs with an ACHD service, a rotation is mandatory. Ideally, Level I trainees should gain first-hand experience in both inpatient and outpatient consultation and management of ACHD. Ideally, the ACHD service will have a robust patient mix (including low, moderate, and high complexity) in both inpatient and outpatient settings. The ACHD service should expose trainees to a wide array of ACHD patients and procedures, and should, at a minimum for the Level I trainee, include exposure to ACHD management within the cardiac subspecialties (e.g., arrhythmia, heart failure, pulmonary hypertension, transplant, intervention, and surgery).

If a program lacks the necessary expertise and patient volume, patient-based education can be achieved through alternative approaches, such as didactic education, with a focus on case-based education. The interpretation of clinical cases should always include the interpretation of testing ranging from electrocardiography to echocardiography or advanced imaging, as well as any interventional procedures. Achievement of Level I training must be accomplished with a focused educational experience, as either a dedicated block or a discrete ACHD clinical experience through the course of other rotations (i.e., regular longitudinal participation in an ACHD outpatient clinic, as either a continuity clinic or component of other rotations).

Fellows seeking more detailed ACHD training than prescribed by the Level I minimum recommendations during the clinical cardiovascular fellowship should obtain robust clinical experiences in the outpatient and inpatient consultation settings, as well as experience in cardiac catheterization, arrhythmia and heart failure management, ICU care, appropriate indications for surgical or catheter-based intervention; exposure to operations; and, importantly, perioperative and postoperative intensive care. Management of ACHD patients admitted for noncardiac diagnoses with a special focus on pregnancy, labor, and delivery must also be a component of this extra training. In each of these clinical settings, trainees should assist in patient care in a supervised setting that provides for patient-centered education in all aspects of ACHD management.

3.3. Hands-On Experience

Hands-on experience is important for training in ACHD management. Cardiovascular trainees should have a hands-on clinical experience to acquire the core competencies for Level I training. During this period, and during rotations on the other cardiac services, trainees should review case histories, physical findings, and electrocardiograms, and log echocardiogram reading, arrhythmia management, and percutaneous and surgical cases involving ACHD patients. Interaction with the ACHD team should not be limited to "on-rotation" time, because exposure to the ACHD patient is likely to become pervasive in all cardiac subdisciplines.

4. SUMMARY OF TRAINING REQUIREMENTS

4.1. Development and Evaluation of Core Competencies

Training and requirements in ACHD 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, practice-based learning and improvement, systems-based practice, interpersonal and communication skills, and professionalism. 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.

Tables 1 and 2 delineate each of the 6 competency domains as well as their associated curricular milestones for

TABLE 1 **Core Competency Components and Curricular Milestones for Training in Adults With Simple Congenital Heart Disease (Atrial Septal Defects, Ventricular Septal Defects, Patent Ductus Arteriosus, Pulmonary Stenosis, Bicuspid Aortic Valve, Coarctation)**

	Competency Component	Milestones (Months)			
MEDICAL KNOWLEDGE		**12**	**24**	**36**	**Add**
1	Know the anatomy, pathophysiology, associated lesions, and natural histories of atrial septal defects (primum, secundum, and sinus venosus) and ventricular septal defects.		I		
2	Know the anatomy, pathophysiology, associated lesions, and natural histories of bicuspid aortic valve, pulmonic stenosis, coarctation of the aorta, and patent ductus arteriosus.		I		
3	Know the risk of development and pathophysiology of pulmonary arterial hypertension in adult patients with congenital heart disease, including issues related to noncardiac surgery, pregnancy, contraception, and exercise.		I		
4	Know the potential reproductive and genetic implications of basic adult congenital heart disease, both for patients and for potential offspring.			I	
5	Know the indications for patient referral to an adult congenital heart disease center.	I			
6	Know the cardinal symptoms physical examination, electrocardiogram, and chest x-ray findings of patients with simple adult congenital heart disease.		I		
7	Know the indications for noninvasive and invasive testing for the evaluation of simple adult congenital heart disease.		I		
8	Know the indications and contraindications for surgical and percutaneous interventions in adult congenital heart disease.			I	
9	Know the indications for endocarditis prophylaxis based on current guidelines.	I			
	EVALUATION TOOLS: chart-stimulated recall, conference presentation, direct observation, and in-training examination.				
PATIENT CARE AND PROCEDURAL SKILLS		**12**	**24**	**36**	**Add**
1	Skill to accurately perform a comprehensive history and physical examination in the patient with simple adult congenital heart disease.		I		
2	Skill to appropriately order and integrate the results of imaging with other clinical findings in the evaluation and management of simple adult congenital heart disease patients.		I		
3	Skill to evaluate and manage patients with simple adult congenital heart disease who have undergone reparative intervention.		I		
4	Skill to evaluate and manage the potential cardiovascular complications of pregnant women with simple adult congenital heart disease.			I	
5	Skill to detect the findings of pulmonary arterial hypertension.		I		
6	Skill to appropriately advise patients with simple congenital heart disease regarding exercise, sports participation, and return to play, including the use of testing to evaluate for safety.		I		
7	Skill to evaluate and manage patients with simple congenital heart disease, including appropriate timing for surgical interventions.		I		
	EVALUATION TOOLS: chart-stimulated recall, conference presentation, and direct observation.				
SYSTEMS-BASED PRACTICE		**12**	**24**	**36**	**Add**
1	Collaborate and coordinate patient care with an adult congenital heart disease center to provide optimal healthcare for appropriate patients with adult congenital heart disease.		I		
2	Demonstrate the ability to provide primary cardiac longitudinal care for patients with simple adult congenital heart disease in association with an adult congenital heart disease center.			I	
	EVALUATION TOOLS: chart-stimulated recall, conference presentation, direct observation, and multisource evaluation.				
PRACTICE-BASED LEARNING AND IMPROVEMENT		**12**	**24**	**36**	**Add**
1	Locate, appraise, and assimilate evidence from scientific resources, such as adult congenital heart disease clinical practice guidelines.		I		
2	Identify knowledge and performance gaps and engage in opportunities to achieve focused education and performance improvement.			I	
	EVALUATION TOOLS: chart-stimulated recall, direct observation, and reflection and self-assessment.				

TABLE 1 Core Competency Components, continued

	Competency Component	Milestones (Months)			
PROFESSIONALISM		**12**	**24**	**36**	**Add**
1	Demonstrate sensitivity and responsiveness to diverse patient populations.	I			
2	Respond to patient needs in a way that supersedes self-interest, including referral of basic adult congenital heart disease patients when appropriate.	I			
	EVALUATION TOOLS: direct observation and multisource evaluation.				
INTERPERSONAL AND COMMUNICATION SKILLS		**12**	**24**	**36**	**Add**
1	Effectively educate patients and families across the range of socioeconomic and cultural backgrounds about adult congenital heart disease management, complications, and lifestyle issues.			I	
2	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.

training in adult congenital heart disease. The milestones are categorized into Level I 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 III skills requires training in a dedicated ACHD program. The tables also describe examples of evaluation tools suitable for assessing competence in each domain.

4.2. Structure and Duration of Training

Because relatively few centers in the United States have amassed a sufficient number of ACHD patients who have been followed in an organized manner, regionalization of training in the care of the complex CHD patients is necessary (6). In addition to meeting requirements for training duration and numbers of procedures performed and/or interpreted, the trainee must demonstrate achievement of specific competencies. A brief discussion of the competencies and training requirements for ACHD follows.

The specific competencies for Levels I and III are delineated in Table 1. Level I competencies must be obtained by all fellows during the 3-year cardiovascular disease fellowship training program. There is no Level II training in ACHD. 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 and III follows. Although these minimum training duration and numbers of procedures are typically required to obtain competency, there must also be demonstration of achievement of the competencies as assessed by the outcomes evaluation measures.

4.2.1. Level I Training Requirements

All cardiovascular trainees should be exposed to a core of information regarding adults with CHD. The goal of Level I training is to have the ability to recognize and evaluate common, simple congenital heart lesions and the sequelae of the more commonly repaired congenital heart defects. These graduates should consult and collaborate with a Level III-trained ACHD specialist when major management decisions are made for adults with CHD and for periodic discussions of ongoing care.

We suggest that at least 6 hours of formal lectures within the core curriculum of the training program be devoted to CHD in adults. Table 1 indicates the content suggested for these 6 hours, covering key basic and clinical aspects of these disorders. With the acknowledgment that there are many teaching styles and organizational strategies to teach the necessary concepts, a proposed curriculum is as follows: Hour 1 = basic anatomy, pathology, physiology, hemodynamics, and known genetics of common lesions and conditions; Hour 2 = clinical diagnosis (history, clinical examination, electrocardiogram, and x-ray) and management of the most common lesions expected to be encountered in adults, operated or not; Hour 3 = specific issues relevant to cyanotic CHD and Eisenmenger syndrome; Hour 4 = a description of the most commonly performed surgical procedures involved in repair and palliation of CHD and a review of the common residua and sequelae encountered in clinical practice; Hour 5 = common echocardiographic

TABLE 2 **Core Competency Components and Curricular Milestones for Training in Caring for Adults With Complex Congenital Heart Disease (Ebstein's Anomaly, Tetralogy of Fallot, Complex Cyanotic Congenital Heart Disease, Transposition of the Great Arteries, Single Ventricle Physiology/Fontan)**

	Competency Component	Milestones (Months)			
MEDICAL KNOWLEDGE		**12**	**24**	**36**	**Add**
1	Know the basic anatomy and pathophysiology of the cyanotic congenital heart diseases encountered in adolescents and adults.		I		
2	Know the natural history of cyanotic congenital heart diseases, particularly those with Eisenmenger Syndrome.		I		
3	Know the hematological complications and their management in patients with cyanotic heart disease.		I		
4	Know the risks of cardiac arrhythmias and their management in patients with adult congenital heart disease.		I		
5	Know the renal complications of cyanotic heart disease, including medications and procedures with the potential for precipitating renal failure.		I		
6	Know the other systemic complications of cyanotic heart disease: pulmonary, orthopedic, and neurological.		I		
7	Know the vulnerability these patients have for mortal complications from routine noncardiac surgical procedures and the risks of intravenous lines without air filters.		I		
8	Know the potential for mortal complications in cyanotic patients, particularly those with pulmonary hypertension, from pregnancy or the use of estrogen-based contraception.		I		
9	Transposition of the great arteries: know the basic anatomy, the types of surgical repair, and their complications in the adult patient.			I	
10	Single ventricle/Fontan: know the basic anatomy and hemodynamics both in patients with and without surgical repair and that noncardiac surgery must be performed at an adult congenital heart disease center.			I	
11	Tetralogy of Fallot: know the basic anatomy; the types of surgical repair; and the postoperative residua and sequelae, including indications and timing of reoperation.			I	
12	Know the anatomy, pathophysiology, and associated lesions of Ebstein's anomaly.			I	
13	Know the indications for patient referral to an adult congenital heart disease center.	I			
14	Know the appropriate indications for and timing of medical, surgical, and interventional therapies in all forms of congenital heart disease.				III
	EVALUATION TOOLS: chart-stimulated recall, conference presentation, direct observation, and in-training examination.				
PATIENT CARE AND PROCEDURAL SKILLS		**12**	**24**	**36**	**Add**
1	Skill to accurately interpret the physical examination, echocardiogram, and electrocardiogram findings in patients with repaired Tetralogy of Fallot.			I	
2	Skill to accurately interpret the physical examination, electrocardiogram, and chest x-ray findings in patients with Eisenmenger physiology.		I		
3	Skill to appropriately use electrocardiography, echocardiography, and other imaging modalities in diagnosis and management of complex adult congenital heart disease.		I		
4	Skill to ensure that female patients have received appropriate contraceptive advice.			I	
5	Skill to collaborate with an adult congenital heart disease specialist before prescribing medications and procedures with the potential to affect hemodynamic stability in patients with cyanotic heart disease.		I		
6	Skill to urgently refer patients to an adult congenital heart disease center in the setting of hemoptysis, transient neurological disturbance, syncope, arrhythmia, pregnancy, or anticipated noncardiac surgery.		I		
7	Skill to interpret echocardiograms, including transesophageal echocardiograms, in all forms of complex congenital heart disease, and to select other appropriate imaging modalities when necessary (magnetic resonance imaging, computed tomography).				III
8	Skill to interpret hemodynamic and angiographic data in all types of complex congenital heart disease.				III
9	Skill to appropriately treat complications of complex congenital heart disease, including hemoptysis, arrhythmias, and heart failure.				III
10	Skill to evaluate and manage patients with all forms of complex congenital heart disease, both operated and unoperated, including appropriate timing for surgical interventions.				III
11	Skill to assess preconceptual risk and manage patients during pregnancy.				III

TABLE 2 Core Competency Components, continued

	Competency Component	Milestones (Months)			
PATIENT CARE AND PROCEDURAL SKILLS		**12**	**24**	**36**	**Add**
12	Skill to appropriately advise patients with all forms of complex congenital heart disease regarding exercise, sports participation, and return to play, including the use of testing to evaluate for safety.				III
	EVALUATION TOOLS: chart-stimulated recall, conference presentation, and direct observation.				
SYSTEMS-BASED PRACTICE		**12**	**24**	**36**	**Add**
1	Establish an ongoing collaborative relationship with an adult congenital heart disease team or center to facilitate prompt access to appropriate advice and urgent admission of cyanotic patients when necessary.	I			
2	Utilize an interdisciplinary team approach with other subspecialists to optimize the care of all patients with moderate and complex congenital heart disease.				III
	EVALUATION TOOLS: chart-stimulated recall, conference presentation, direct observation, and multisource evaluation.				
PRACTICE-BASED LEARNING AND IMPROVEMENT		**12**	**24**	**36**	**Add**
1	Identify strengths, deficiencies, and limits in one's knowledge and expertise in cyanotic heart disease and carry out personalized education to address them.			I	
2	Locate, appraise, and assimilate evidence from scientific resources, such as adult congenital heart disease clinical practice guidelines, and apply that knowledge to the management and care of patients.		I		
3	Identify knowledge and performance gaps and engage in opportunities to achieve focused education and performance improvement.				III
	EVALUATION TOOLS: chart-stimulated recall, direct observation, and reflection and self-assessment.				
PROFESSIONALISM		**12**	**24**	**36**	**Add**
1	Demonstrate sensitivity and responsiveness to diverse patient populations.	I			
2	Demonstrate a commitment to carry out professional responsibilities, appropriately refer patients, and respond to patient needs in a way that supersedes self-interest.	I			
	EVALUATION TOOLS: direct observation, multisource evaluation				
INTERPERSONAL AND COMMUNICATION SKILLS		**12**	**24**	**36**	**Add**
1	Effectively educate patients and families across the range of socioeconomic and cultural backgrounds about adult congenital heart disease management, complications, and lifestyle issues.			I	
2	Communicate and work effectively with physicians and other professionals on the healthcare team, including those at an adult congenital heart disease center.	I			
	EVALUATION TOOLS: direct observation and multisource evaluation.				

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

features in operated and unoperated adult CHD; and Hour 6 = various topics, which could include management during pregnancy, endocarditis prophylaxis, and basic counseling on genetics and contraception, employment, and exercise. Within those 6 hours of core curriculum, the trainees should be taught the major outpatient management issues in ACHD and when to consult or refer for more specialized advice. Currently available modes of supplementing this education include readily available ACC educational products (ACHD section of the Adult Clinical Cardiology Self-Assessment Program [ACCSAP] and the Echocardiography Self-Assessment Program) and web-based sites specific to CHD. Additional content could include areas such as preoperative noncardiac surgery assessment, evaluation and management of heart failure, and CHD-related pulmonary hypertension.

In addition to the didactic material in the core curriculum, trainees should be exposed to ACHD patients on a regular basis. This could be done in the context of ongoing weekly case conferences, which may already be part of the cardiovascular training program. In addition, trainees are encouraged to become involved in an ongoing CHD outpatient clinic, to see older children or adolescents with a pediatric cardiology colleague, or both.

If not available at the training institution, regional ACHD case conferences may provide an opportunity for fellows to receive exposure to ACHD management at dedicated centers.

Cardiovascular trainees should be exposed to the evaluation of CHD with various diagnostic modalities during the usual clinical rotations (electrocardiography, electrophysiology, transthoracic and transesophageal echocardiography, nuclear cardiology, and the cardiac catheterization laboratory [including invasive transcatheter techniques]). Exposure to other advanced imaging techniques now commonly utilized in CHD (e.g., MRI and CT) as well as cardiopulmonary exercise testing is highly desirable. Didactic material for these rotations should include materials on diagnosis and management of the adult with CHD.

A 4-week rotation is strongly recommended to complete Level I competence if the training program has expertise in ACHD with a board-eligible/board-certified cardiologist on staff (or equivalent experience). If the training program does not have expertise in CHD or have access to CHD locally, partnering with an expert regional ACHD facility for an elective rotation of 4 weeks total duration may be a valuable supplement. A similar recommendation exists for pediatric cardiovascular trainees. Thus, partnership with a pediatric cardiovascular program can facilitate collaboration as well as effective resource utilization.

4.2.2. Level III Training Recommendations

Level III training prepares the cardiologist to specialize in advanced care for the adult with CHD. In order to obtain a comprehensive understanding of all aspects of CHD, a 2-year program (following either internal medicine or pediatric cardiovascular fellowship) is necessary with ongoing participation in clinical practice relating to CHD. The ACGME is currently reviewing the ABIM and ABMS petition and establishing curriculum guidelines; it has defined the essential components of a specialized program for training in ACHD. Level III training should align with the ACGME curriculum as this is planned per the current timeline to be part of fellowship training in July 2016. The ABIM will begin to offer an examination for this additional certification in 2015. Information concerning the eligibility requirements for the examination can be obtained from the ABIM. There will be 2 pathways, with the chosen path depending on whether the trainee's background is in adult or pediatric cardiology. Pediatric cardiologists will devote a portion of their training to areas of adult internal medicine and cardiology to fulfill requirements and competencies necessary to care for adults with CHD. Adult cardiologists will complete additional training in pediatric cardiology for the same purposes.

It is, therefore, expected that trainees should:

1. Participate in a regular outpatient clinic organized for the care of adults with CHD for at least 18 of the 24 months. The Level III trainee should be involved with the care of a minimum of 10 patients per week. Programs that are able to provide Level III training will have clinic more than once a week. The Level III trainee should participate in clinic at least once a week and for much of the training period will need to be in clinic more often to obtain appropriate exposure.
2. Participate in a total block or cumulative equivalent of at least 9 months of inpatient consultative services providing care for ACHD patients. This typically includes consultation for admissions related to heart failure, arrhythmias, preoperative and postoperative care, and noncardiac issues.
3. Participate in at least 3 months of comprehensive imaging methods used in caring for ACHD patients, including direct experience in echocardiography (transthoracic and transesophageal) and advance imaging techniques (MRI and CT).
4. Participate in at least 2 months of cardiac catheterization (diagnostic and interventional) that includes understanding indications for intervention, hemodynamics, diagnostic angiography, and physiological calculations.
5. Participate in at least 1 month of dedicated cardiothoracic intensive care unit and surgical service for the care of ACHD patients. This includes preoperative assessment and intraoperative (including direct observation of surgical repair) and postoperative care.
6. Participate in at least 3 months of formal rotations in pediatric cardiology (for those following the adult cardiovascular pathway) for either a total block or cumulative equivalent months, including exposure to neonates and children with CHD via conferences, outpatient clinics, diagnostic laboratories (e.g., echocardiography, catheterization laboratory), and inpatient services, including consultations and exposure to children with postoperative CHD in the intensive care unit. Given that such fellows will not likely be experienced in the critical care of pediatric patients, all inpatient participation should be observed and supervised by experienced pediatric cardiologists.
7. Participate in at least 3 months of formal rotations in adult cardiology (for those following a pediatric cardiology pathway) for either a total block or cumulative equivalent months, including exposure to adults with acquired heart disease through outpatient clinics, diagnostic laboratories (e.g., echocardiography, catheterization laboratory), and inpatient services, including consultations. Trainees with a pediatrics

residency background prior to pediatric cardiology will require additional time gaining basic competencies in adult internal medicine and adult comorbidities.

8. Perform and interpret cardiopulmonary exercise testing in CHD individuals and apply that data to clinical assessment as well as exercise prescription.
9. Perform outpatient follow-up and inpatient management (with obstetrics/anesthesia) of pregnancy in CHD.
10. Participate in inpatient and outpatient care of CHD individuals with advanced heart failure, including consideration of mechanical support or transplant.
11. Participate in the inpatient and outpatient care of CHD individuals with significant pulmonary arterial hypertension, including specific medical therapies and transplantation.
12. Gain experience with the arrhythmic complications of CHD and the various approaches to their management, both pharmacological and interventional.

Training should include active participation in clinical and/or laboratory research in conjunction with clinical activities. Direct participation in cardiac catheterization procedures in CHD is necessary to develop and demonstrate a comprehensive understanding of the entire hemodynamic spectrum of anatomic abnormalities in CHD. The specific number of cases and methods of assessing competencies will be developed through the ACGME. Specialized training is necessary to achieve expertise in the appropriate timing of surgical and interventional procedures as well as expertise in the potential complications. Expertise in the management of all complications of a wide variety of simple and complex congenital cardiac lesions, both unrepaired and repaired, is necessary, including the treatment of heart failure, arrhythmias, pulmonary hypertension, and pregnancy, as well as contraception management and knowledge of indications for referral for genetic counseling. Finally, trainees must be competent in the interpretation of transthoracic and transesophageal echocardiograms across the spectrum of CHD as well as the diagnosis of valvular disease and cardiomyopathic conditions. The specific numbers of cases has not yet been determined by the ACGME. It is anticipated that such competence would require at least 300 transthoracic echocardiograms and 50 transesophageal echocardiographic examinations to ensure that adequate exposure and expertise have been acquired in the wide range of complex cardiac pathology that might be encountered in practice. Although Level III MRI or CT training is not required, the advanced trainee should also be trained in the indications for and interpretation of advanced imaging techniques (i.e., MRI and/or CT and angiography in CHD). Trainees who have completed this additional 2-year training will be eligible to take the ABIM subspecialty examination.

5. EVALUATION OF COMPETENCY

Evaluation tools in ACHD include direct observation by instructors, in-training examinations, case logbooks, conference and case presentations, multisource evaluations, trainee portfolios, 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 reporting standards and summarizes pertinent clinical information (e.g., number of cases, diversity of referral sources, diagnoses, disease severity, outcomes, and disposition).

Under the aegis of the program director, the faculty 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 Competency Committee to ensure achievement of selected training milestones and identify areas in which additional focused training may be required.

The ACGME has defined the essential components of a specialized program for training in ACHD; the ABIM will begin to offer an examination for this additional certification in 2015. Information concerning the eligibility requirements for the examination can be obtained from the ABIM.

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KEY WORDS ACC Training Statement, clinical competence, COCATS, congenital heart disease, fellowship training

APPENDIX 1. AUTHOR RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—COCATS 4 TASK FORCE 14: TRAINING IN CARE OF ADULT PATIENTS WITH CONGENITAL HEART DISEASE

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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; CV = cardiovascular.

APPENDIX 2. PEER REVIEWER RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—COCATS 4 TASK FORCE 14: TRAINING IN CARE OF ADULT PATIENTS WITH CONGENITAL HEART DISEASE

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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; ACPC = Adult Congenital and Pediatric Cardiology.

APPENDIX 3. ABBREVIATION LIST

ABIM = American Board of Internal Medicine

ABMS = American Board of Medical Specialties

ACC = American College of Cardiology

ACCSAP = Adult Clinical Cardiology Self-Assessment Program

ACGME = Accreditation Council for Graduate Medical Education

ACHD = adult congenital heart disease

CHD = congenital heart disease

COCATS = Core Cardiovascular Training Statement

CT = computed tomography

HIPAA = Health Insurance Portability and Accountability Act

MRI = magnetic resonance imaging