Task Force 6: Pediatric Cardiology Fellowship Training in Adult Congenital Heart Disease[1]

Karen Stout, MD, FACC, Co-Chair, Anne Marie Valente, MD, FACC, Co-Chair, Peter J. Bartz, MD, FASE, Stephen Cook, MD, FACC, Michelle Gurvitz, MD, MS, FACC, Arwa Saidi, MD, FACC, Robert D. Ross, MD, FAAP, FACC

PII: S0735-1097(15)00816-5

DOI: 10.1016/j.jacc.2015.03.011

Reference: JAC 21061

To appear in: *Journal of the American College of Cardiology*

Please cite this article as: Stout K, Valente AM, Bartz PJ, Cook S, Gurvitz M, Saidi A, Ross RD, Task Force 6: Pediatric Cardiology Fellowship Training in Adult Congenital Heart Disease[1], *Journal of the American College of Cardiology* (2015), doi: 10.1016/j.jacc.2015.03.011.

ACCEPTED MANUSCRIPT

Task Force 6: Pediatric Cardiology Fellowship Training in Adult Congenital Heart Disease[1]

Karen Stout, MD, FACC (Co-Chair); Anne Marie Valente, MD, FACC (Co-Chair); Peter J. Bartz, MD, FASE; Stephen Cook, MD, FACC; Michelle Gurvitz, MD, MS, FACC; Arwa Saidi, MD, FACC; Robert D. Ross, MD, FAAP, FACC

1. Introduction

1.1. Document Development Process

The Society of Pediatric Cardiology Training Program Directors (SPCTPD) board assembled a steering committee which nominated 2 chairs, 1 SPCTPD steering committee member, and 4 additional experts from a wide range of program sizes, geographic regions, and subspecialty focus. Representatives from the American College of Cardiology (ACC), American Academy of Pediatrics (AAP), and American Heart Association (AHA) participated. The steering committee member was added to provide perspective to each task force as a "non-expert" in that field. Relationships with industry and other entities were not deemed relevant to the creation of a general cardiology training statement; however, employment and affiliation information for authors and peer reviewers are provided in Appendices 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 (http://jaccjacc.acc.org/Clinical_Document/Ped_TS_TF6_Comprehensive_RWI_Supplement.pdf).

The writing committee developed the document, approved it for review by individuals selected by the participating organizations (Appendix 2), and addressed their comments. The final document was approved by the SPCTPD, AAP, and AHA in February 2015 and approved by the ACC in March 2015. This document is considered current until the SPCTPD revises or withdraws it.

1.2. Background and Scope

It is estimated that there are currently more adults than children with congenital heart disease (CHD). Despite this, most adult cardiologists are not familiar with CHD and to date pediatric cardiology

[1] The American College of Cardiology requests that this document be cited as follows: Stout K, Valente AM, Bartz PJ, Cook S, Gurvitz M, Saidi A, Ross RD. Task force 6: pediatric cardiology fellowship training in adult congenital heart disease. J Am Coll Cardiol. 2015;••:••••–••••.

ACCEPTED MANUSCRIPT

training has not focused on typical adult diseases or on the social issues that impact adults. Pediatric cardiology training will provide a sound basis for the diagnosis and management of CHD that spans all ages; however the manifestations, diagnosis, treatments, and outcomes of CHD in adults has important differences from those diseases in children.

The goal of Adult Congenital Heart Disease (ACHD) training for pediatric cardiology fellows is to expose them to the common sequelae of both repaired and unrepaired CHD in the adult. This presupposes that the trainee has a solid foundation in the principles of CHD diagnosis and management gained through their pediatric cardiology training. Additional subjects for trainees to learn should include the common medical conditions encountered in adults such as coronary disease, pregnancy, and depression. The impact of issues such as employment and insurability should also be a part of the curriculum as they strongly impact patient well-being.

A smooth transition of patients from pediatric to adult care is the first step in ACHD care, and in most medical systems that responsibility lies with the pediatric providers. Therefore, education on the transition process, awareness of the needs of ACHD patients, systems available for care of ACHD patients, and resources to ensure adequate cardiac care, are all important parts of the pediatric cardiology curriculum in ACHD.

There are a variety of ways to fulfill the training goals in ACHD. The ideal experience combines didactic lectures and dedicated inpatient and outpatient ACHD clinical rotations. There is substantial variation between institutions in the care of ACHD patients, and pediatric cardiology fellowship training programs should avail themselves of dedicated ACHD-trained or experienced cardiologists and ACHD programs. For those fellows desiring to care for ACHD patients, additional subspecialty training is required which is more intensive and focused than the ACHD training in either pediatric or adult cardiology programs. What follows are descriptions of the different issues that should be addressed in core ACHD training for pediatric cardiology fellows. For those who desire to pursue a career as an ACHD specialist, 2 years of additional training will be needed to fulfill the requirements for the ACHD Board Certification exam.

Our revised training recommendations describe the program resources and environment that are required for training pediatric cardiology fellows, together with a competency-based system promulgated by the American College of Graduate Medical Education (ACGME), to implement specific goals and objectives for training pediatric cardiology fellows. This system categorizes competencies into 6 core competency domains: Medical Knowledge, Patient Care and Procedural Skills, Systems-Based Practice,

ACCEPTED MANUSCRIPT

Practice-Based Learning and Improvement, Professionalism, and Interpersonal and Communication Skills, along with identification of suggested evaluation tools for each domain. Core competencies unique to ACHD are covered in Section 3 (see the Training Guidelines for Pediatric Cardiology Fellowship Programs Introduction for additional competencies that apply to all Task Force reports).

1.3. Levels of Expertise – Core and Advanced

In this statement, we discuss core training for all fellows enrolled in a traditional 3-year pediatric cardiology fellowship and advanced training for fellows who wish to embark on a career in ACHD. Core training is required for all trainees and is intended to ensure that fellows acquire the knowledge base and skills necessary to become a pediatric cardiologist referring his/her patient at an age appropriate for ACHD care. Advanced training guidelines are recommended for fellows who wish to specialize in ACHD following training. In December 2012, after a joint petition by the American Board of Pediatrics and American Board of Internal Medicine, ACHD was formally recognized by the American Board of Medical Specialties as a subspecialty of adult and pediatric cardiology. As such, advanced training is needed to qualify a fellow to sit for the ACHD Board exam and to be an ACHD cardiologist. Advanced ACHD training is for an additional 2 years after completion of either pediatric cardiology or adult cardiovascular disease training. The specifics of the ACHD training pathways are being developed and are part of the 2015 adult cardiology training guidelines (1).

2. Program Resources and Environment

Training in ACHD should be obtained in a center or centers where there is both a pediatric and an adult cardiology training program accredited by the Accreditation Council for Graduate Medical Education (ACGME). Ideally, the training center has available ACHD expertise from at least 1 trained or experienced ACHD cardiologist, multidisciplinary ACHD experience, and a dedicated ACHD program or clinic. This center should have clinical volumes sufficient to allow for exposure of each trainee to a wide spectrum of ACHD. If the training center lacks ACHD expertise, consideration for “away rotations” and electronic educational resources to ensure attainment of training requirements should be considered.

Pediatric cardiology trainees should be aware of the 2008 American College of Cardiology/American Heart Association (ACC/AHA) guidelines (2) regarding care of patients in ACHD centers. This may involve routine primary cardiology care at the ACHD center or shared care with a local referring cardiologist. The type and location of care recommended depends on the severity and complexity of the underlying condition. The 32nd Bethesda conference (3) outlines the components of a

ACCEPTED MANUSCRIPT

comprehensive regional ACHD referral center. It is recommended that non-ACHD adult or pediatric cardiologists caring for adults develop a referral relationship with an established center.

At a core competency level, there are several mechanisms that would fulfill the training goals in ACHD. The exposure to dedicated ACHD care should occur early within the pediatric cardiology fellowship, ideally within the first year of training. For many programs, a dedicated 1-month rotation with an established ACHD program is preferred. The rotation would allow a spectrum of exposure to ACHD patients, include outpatient clinic, inpatient consults, imaging, and exposure to the array of issues ACHD patients may face, including CHD related cardiac issues, non-CHD cardiac issues (i.e., coronary disease), cardiac and noncardiac surgery, heart failure, pulmonary hypertension, and obstetrics. If there are no dedicated local ACHD programs, then local hospital-based GME should provide support for an away elective. With over 100 established ACHD programs throughout the country, most pediatric cardiology fellowship programs are in coordination with an ACHD program or a program exists within close proximity. However, if there are no local ACHD programs or an away-elective is not feasible for various reasons, online modules should be utilized as part of the requirements for pediatric cardiology fellows. Many sources exist for this information and program directors must be familiar with the various online learning opportunities to create the best possible learning experience for their pediatric cardiology trainees if a dedicated ACHD rotation is not feasible.

Trainees should be familiar with the multiple environments in which ACHD patients are followed for both inpatient (adult hospitals, children's hospitals, and combined hospitals) and outpatient care (pediatric cardiology, general adult cardiology, ACHD cardiology). They should also recognize that many patients are "lost" or neglect follow-up and may be seen only in general practice environments such as family or internal medicine, or may receive no medical care at all unless emergencies arise. It is common for ACHD patients to present to an emergency room with little knowledge of their heart condition, prior surgeries and interventions, or even their medications.

It is important for fellows to understand when to refer ACHD patients for non-congenital adult medical expertise (cardiac and noncardiac) including the fields of general internal medicine, obstetrics, gynecology, nephrology, hepatology, hematology, and psychiatry. Specific exposure to multidisciplinary teams caring for ACHD should be emphasized including those outlined in Table 1.

Table 1. Multidisciplinary Teams Involved in ACHD Care

- High-risk obstetrics
- Pulmonary hypertension
- Heart failure/transplant

ACCEPTED MANUSCRIPT

- Genetics
- Neurology
- Nephrology
- Cardiac pathology
- Rehabilitation services
- Social services
- Vocational services
- Financial counselors

Adapted from the 2008 ACC/AHA Guidelines for Management of Adults with Congenital Heart Disease (2).

Any diagnostic or interventional procedures for adults with moderate or complex CHD including (but not limited to) catheterization, surgery, echocardiography, or cardiac MRI should be performed in a location and by personnel with expertise in that modality and ACHD. For procedures requiring anesthesia, it is important to include cardiac anesthesiologists with experience with ACHD.

3. Core Training: Goals and Methods

Trainees will be expected to develop an appropriate level of knowledge and experience in the following areas:

3.1. Managing the Transition From Adolescence to Adulthood

Transitioning the care of the adolescent to adulthood should begin with encouraging greater patient involvement in their health care. Emphasis should be placed on uninterrupted health care that is patient centered, age and developmentally appropriate, flexible, and comprehensive. Age-appropriate education about medical conditions should promote skills in communication, decision-making, self-care, and self-advocacy. This will promote greater personal and medical independence and a sense of control over healthcare decisions. The ultimate goal of a transition program is to optimize the quality of life, life expectancy, and future productivity of young patients (2). Specific teaching goals include learning:

- The concept of comprehensive care that is coordinated and managed through a medical home.
- The need to educate adult providers in managing chronic conditions previously limited to the pediatric population.
- The need for ongoing, coordinated communication between patients, families, and pediatric and adult healthcare providers to facilitate transition and transfer.
- The timing for transition should be based on the patient's medical and development status and should be individualized to both the patient and their families' needs.

ACCEPTED MANUSCRIPT

- The need to engage the adolescent in transition planning, raising awareness in the early teenage years.
- The need for the pediatric cardiology provider to initiate and work together with the adolescent and their family on a transition plan.
- The importance of pediatric providers directing health discussions toward the adolescent in a way that is developmentally appropriate and sensitive to parental concerns.

3.2. Recognition of Concomitant Adult Medical Conditions

Adults with CHD may develop comorbidities that can either complicate the management of CHD or worsen the outcomes of CHD. The care of adults with CHD requires familiarity with common adult medical conditions, both cardiac and noncardiac, and awareness of available guidelines to treat them. Important conditions include coronary artery disease, acute myocardial infarction, heart failure, hypertension, hyperlipidemia, atrial fibrillation, stroke, diabetes mellitus, metabolic syndrome, sleep apnea, obstructive lung disease, obesity, lifestyle issues including tobacco, alcohol and drug use, exercise, and depression/anxiety.

Familiarity with the commonly used medical therapies for adult-acquired heart disease is needed, including statins, aspirin, beta blockers, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers, aldosterone antagonists, and anticoagulants. Trainees must also learn the difference in accepted indications for pediatric and adult patients for these medications.

Pediatric cardiologists are not expected to manage uniquely adult cardiac or noncardiac conditions, but need to be aware of available resources for appropriate internist, cardiologist, or other subspecialty referrals.

3.3. Knowledge of Electrophysiology in ACHD Care

Arrhythmias are common in ACHD patients, and effective diagnosis and management requires understanding of the underlying anatomy, surgical repairs, and treatment options (4). While there are many similarities in the diagnosis and management of arrhythmias in ACHD patients compared to pediatric patients, the presentation, complications, management options, and outcomes may be quite different. There are subgroups of ACHD in whom the risk for arrhythmias increases with age such as Mustard/Senning repairs of transposition of the great arteries (TGA) and atriopulmonary Fontan

ACCEPTED MANUSCRIPT

palliations. These patients are prone to both tachyarrhythmias and bradyarrhythmias, therefore a thorough understanding of these operations is essential.

Anticoagulation for stroke prevention may differ in ACHD patients due to advancing age and comorbidities. Management may be helped by the ACC/AHA guidelines regarding stroke prevention in the presence of atrial arrhythmias (5).

3.4. Management of Advanced Heart Failure and Determination of Transplant Candidacy in ACHD Patients

As the population of adults with CHD continues to increase, so does the prevalence of heart failure. Pediatric cardiology fellowship training should include an understanding of the multiple factors that contribute to ventricular dysfunction in adults with CHD (6, 7), including abnormal vascular function, particularly in those with Fontan physiology (8, 9).

Training should emphasize that ACHD patients who are at significant risk of heart failure, particularly those with systemic right ventricles, including Mustard/Senning repairs of TGA and congenitally-corrected TGA, as well as patients with a single ventricle who have undergone a Fontan procedure (10). They should also understand the neurohormonal abnormalities that frequently accompany heart failure in these adults (11).

Each fellow should have an understanding of the currently available options for mechanical circulatory support (MCS) in adult congenital heart patients (12) and participate in multidisciplinary team discussions regarding optimal timing of referral of adults with CHD for MCS/transplant (13). Fellows should also understand the potential difficulties or contraindications of transplant in adults. This may range, for example, from issues of alloimmunization to technical limitations to pulmonary hypertension to substance use.

3.5. Understanding the Unique Aspects of Caring for Cyanotic Adults With Eisenmenger Syndrome and Pulmonary Vascular Disease

A subset of ACHD patients live with cyanosis, either from unrepaired or palliated CHD or reversal of a left-to-right shunt due to Eisenmenger syndrome (ES). These adults may present with multisystem dysfunction from the secondary erythrocytosis that occurs due to their hypoxemia. Fellows need to recognize these complications which include iron deficiency, gallstones, gout, and cerebral vascular accidents. They also should know the therapies to prevent these complications (e.g., avoidance of dehydration, iron replacement) (14). ACHD patients may also suffer from pulmonary vascular disease. In 1 large population-based study, the prevalence of pulmonary hypertension in ACHD patients is at least

ACCEPTED MANUSCRIPT

6%; and those patients had a more than 2-fold higher risk of all-cause mortality and 3-fold higher risk of heart failure and arrhythmias compared to those without pulmonary hypertension (15). The trainee should be aware of recent investigations of advanced therapies for pulmonary vascular disease in ACHD patients which have offered promise for improved quality of life and survival (16). Despite guideline recommendations to treat adults with ES with pulmonary vasodilator therapy (Class IIa, Level of Evidence C) (2), the majority of patients living with ES are not receiving advanced therapies (17).

3.6. Recognition of the Importance of Palliative Care

Although the prognosis for many adults with CHD is quite good with appropriate management, there are many patients who will die of their underlying CHD. For many patients with end-stage disease, there are surgical, medical, or advanced heart failure therapies such as ventricular assist devices or transplantation that can improve symptoms or longevity. However, many patients may not realistically benefit from further aggressive treatment or may choose not to continue therapy. If so, palliative care may be an appropriate option. The difficulty in providing accurate prognostic data for ACHD patients can make the optimal timing for palliative care referrals difficult. There are prognostic indicators in adults with heart failure due to other causes that may also apply to ACHD patients and fellows should be familiar with these resources.

3.7. Understanding Mental Health and Cognitive Outcomes

The trainees need to be aware of the potential for neurocognitive and psychological issues in ACHD patients. For example, there is at least a 3 times higher prevalence of psychiatric disorders, particularly depression and anxiety, among adults with neurocognitive delays (18). There is equivocal data on health-related quality of life in ACHD patients compared to the general population depending on the mode of evaluation. Some genetic syndromes, such as 22q11 deletion, include a component of developmental delay and the potential for adult onset psychiatric disorders (19). At this time, screening for depression, anxiety, and other mood disorders is not in the ACHD guidelines, but it is recommended that ACHD care providers be aware of these issues and intervene or refer when appropriate.

It is also important for trainees to recognize the impact that neurocognitive delay and impaired social adjustments may have on future lifestyle issues in adulthood. This is particularly true for assuming independence, disease self-management, and employment. Appropriate counseling, particularly on employment options, should be considered.

ACCEPTED MANUSCRIPT

3.8. Assess Safety of Participation in Sports and Exercise

The most common congenital or inherited heart conditions that have been associated with sudden death during sports and exercise participation are hypertrophic cardiomyopathy, coronary artery anomalies, Marfan syndrome, and aortic valve disease. Less common lesions with increased risks are complex defects, such as repaired transposition and single ventricle, and those with associated pulmonary vascular disease. In addition, sudden death may occur with arrhythmias induced by exercise from certain forms of congenital long QT syndrome. As adolescents and young adults enroll in progressively more demanding activities, comprehensive evaluation and counseling are essential. The goal should be to assess the safety of participation in sports and exercise in order to optimize quality of life and improve health. Trainees should be familiar with the appropriate diagnostic testing needed and the specific recommendations described within the 36th Bethesda Conference report (20). Equally important is providing support, alternatives, and counseling for those ACHD patients who are no longer able to participate in sports they may have enjoyed in the past due to the health risks they pose.

3.9. Recognition of Women's Reproductive Health: Contraception and Pregnancy

Over the course of training in pediatric cardiology, fellows must learn the hemodynamic changes that occur during pregnancy and the postpartum period. Each fellow should demonstrate knowledge of the pregnancy-related physiologic changes in women with various types of CHD during pregnancy and their potential consequences on both the mother and fetus (21). They also need to know the established risk factors for pregnant women with CHD for both maternal cardiac and obstetrical complications (22-24), genetic risks of recurrence of CHD in the fetus, as well as late adverse cardiac outcomes (25). Each fellow should obtain experience in counseling young women of childbearing age with CHD regarding these potential risks. Fellows should understand the hematological changes that occur during pregnancy and develop appropriate therapeutic strategies for women with heart disease requiring anticoagulation during pregnancy (26). They should be educated regarding appropriate contraceptive choices in young patients with CHD and provide counseling regarding contraceptive choices (27, 28). Each fellow should get exposure to the multidisciplinary team with the maternal-fetal medicine group to care for pregnant young women with CHD. Additionally, pediatric cardiology fellows should be educated in the acute care management of cardiac issues that can arise (i.e., hypertension, arrhythmias) during pregnancy in women with underlying CHD (21).

ACCEPTED MANUSCRIPT

3.10. Assessment of Sexual Function

Among patients with cardiovascular disease, sexual problems are highly prevalent in both men and women and have been shown to adversely affect the patients' quality of life and well-being (29). To date, the discussion of sexual dysfunction in adults with CHD is often neglected. Recent studies have described an increased prevalence of erectile dysfunction (30), decreased sexual esteem, and/or distress with sex in adults with CHD (31).

Therefore, it is important for fellows to understand the complex relationship between cardiovascular disease, erectile dysfunction, and endothelial dysfunction (32). Endothelial dysfunction is not only an important process in the development of atherosclerotic cardiovascular disease but also plays a role in the pathophysiologic mechanisms that contribute to erectile dysfunction. Sexual activity is reasonable in most adult congenital patients who do not have decompensated heart failure, severe valvular disease, or uncontrolled arrhythmias (*Class IIa; Level of Evidence C*) (33).

3.11. Knowledge of the Legislative Aspects of Employment and Advocacy

Key aspects of providing quality of care for the adult with CHD include not only addressing late medical and surgical complications, but also the numerous social and psychological adjustments that affect day-to-day life. This includes vocational planning that should begin in adolescence so that appropriate educational options have been established long before the patient enters the work force (34). Although reports of employment status vary with CHD, no more than 10% are considered totally disabled (35). As many adults with CHD prepare to enter the job market and establish a career (36), careful consideration of both physical and psychological capabilities should be discussed with their cardiologist so that realistic employment options are explored. Crossland et al. demonstrated that structured career and employment advice has been shown to be associated with a higher rate of employment (73%) than no such counseling (46%) (37). Therefore, a review of the American Heart Association (AHA) published guidelines, "Recreational and Occupational Recommendations for Young Patients with Heart Disease" (38) with patients with CHD and their parents should be performed to objectively assist with occupational counseling.

Knowledge of the legislative aspects of employment and advocacy may not be routine in the outpatient assessment in the adult with complex CHD. However, keys to overcoming these barriers include the development of educational materials or hand-outs to help adolescents and young adult patients as they approach the job market that focus on legal rights and tips for job success and where to go

ACCEPTED MANUSCRIPT

for job training and/or vocational counseling. The involvement of an adult congenital medical social worker who is knowledgeable of state programs is most helpful to optimize opportunities.

The core curricular competencies for pediatric transition to ACHD are summarized in Table 2, grouped by ACGME core competency domain, and showing corresponding evaluation tools.

Table 2. Core Curricular Competencies and Evaluation Tools for ACHD

Medical Knowledge

- Know the unique aspects of caring for cyanotic adults, including Eisenmenger syndrome and pulmonary vascular disease.
- Know the electrophysiologic abnormalities specific to ACHD patients.
- Know the mental health and cognitive outcomes in ACHD patients.
- Know the complex relationship between cardiovascular disease, erectile dysfunction, and endothelial dysfunction.

Evaluation Tools: direct observation, conference participation and presentation, in-training exam

Patient Care and Procedural Skill

- Have the skills to manage the transition from adolescence to adulthood care of congenital heart disease.
- Have the skills to recognize concomitant adult medical conditions in ACHD patients.
- Have the skills to manage advanced heart failure and determine transplant candidacy in ACHD patients.
- Have the skills to initiate palliative care when appropriate.
- Have the skills to assess safety for ACHD patients to participate in sports and exercise.
- Have the skills to manage reproductive health issues in women with ACHD (i.e., contraception and pregnancy).

Evaluation Tools: direct observation, conference participation, in-training exam, procedure logs

Systems-Based Practice

- Know the legislative aspects of employment and advocacy in ACHD patients.

Evaluation Tools: direct observation, conference participation, in-training exam

ACHD indicates adult congenital heart disease.

4. Advanced Training: Goals and Methods

Advanced ACHD training requires an additional 2 years after completion of either pediatric cardiology or adult cardiovascular disease training. The specifics of the ACHD training pathways are being developed and a summary of the proposed requirements are listed in Table 3.

Table 3. Advanced Training in Adult Congenital Heart Disease: Proposed Requirements Applicable to Trainees From a Pediatric Cardiology Training Background

- Participate in a regular outpatient clinic organized to care for adults with congenital heart disease. The trainee should be involved in the care of at least 10 clinic patients per week, ideally at least 1 clinic per week, though more may be necessary.
- Experience a range of diagnostic and therapeutic methods used in the care of adults with CHD, including direct experience in echocardiography, magnetic resonance imaging, computed tomography, diagnostic catheterization, and exercise testing.
- Participate in the perioperative evaluation of adults with CHD for both cardiac and noncardiac procedures, and observe operative repairs.

ACCEPTED MANUSCRIPT

- Participate in outpatient evaluation and inpatient management of pregnancy in women with CHD.
- Participate in inpatient and outpatient management of adults with CHD and heart failure and/or pulmonary arteriolar hypertension. Participate in medical management of these patients, as well as exposure to discussion/implementation of mechanical circulatory support and transplant as options for treatment.
- Participate in the diagnosis and management of the arrhythmic complications seen in adults with CHD, both medical therapy and interventional options.
- For those with training in pediatric cardiology but not adult cardiology, participate in the internal medicine rotations that focus on acquired medical and cardiac disease that affect adults with CHD. This can include inpatient and outpatient general adult cardiology, heart failure/transplant, and noncardiology specialties.

CHD indicates congenital heart disease.

5. Evaluation and Documentation of Competence

All training programs should include written goals and objectives for each ACHD rotation with performance goals set according to the fellow's level of training. These will serve as the basis for formative feedback. A copy of these goals and objectives should be supplied and explained to the trainee at the onset of fellowship training and reviewed at the beginning of each rotation. Evaluation of fellows should be performed midway through, and at the completion of, each rotation; evaluations should be directed towards whether the fellow met those pre-specified aims. The fellow evaluation should be performed by the ACHD director and/or senior ACHD physician. The fellow evaluation should assess the fellow's performance in each of the 6 areas of core competencies, as appropriate for the level of training, and should be based on direct observation of the fellow. Evaluation of competency in preparation, performance, and interpretation of the results of a procedure should be given more consideration than a focus on the number of procedures performed. Evaluation of competency should be done in person with the trainee and documented in their fellowship record. If the trainee is not progressing as expected, remedial actions should be arranged and documented in accordance with institutional procedures. All fellows should maintain a log (preferably electronic) of all procedures performed.

ACCEPTED MANUSCRIPT

APPENDIX 1. AUTHOR RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—TASK FORCE 6: PEDIATRIC FELLOWSHIP TRAINING IN ADULT CONGENITAL HEART DISEASE

Committee Member	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional/ Organizational or Other Financial Benefit	Expert Witness
Karen Stout *(Co-Chair)*	University of Washington—Director, Adult Congenital Heart Disease Program	None	None	None	None	None	None
Anne Marie Valente *Co-Chair)*	Boston Children's Hospital, Brigham and Women's Hospital—Boston Adult Congenital Heart (BACH) Program Outpatient Director and BACH Senior Fellowship Co-Director; Harvard Medical School—Assistant Professor of Pediatrics and Medicine	None	None	None	None	None	None
Peter J. Bartz	Children's Hospital of Wisconsin, Medical College of Wisconsin—Associate Professor of Pediatrics & Medicine; Director, Clinical Cardiology; and Director, Pediatric Cardiology Fellowship Program	None	None	None	None	None	None
Stephen Cook	Children's Heart Institute of Pittsburgh of UPMC—Associate Professor of Internal Medicine & Pediatrics and Director, Adolescent and Young Adult Congenital Heart Disease Center	None	None	None	None	None	None
Michelle Gurvitz	Boston Children's Hospital, Brigham and Women's Hospital, Harvard Medical School—Assistant Professor, Pediatrics	None	None	None	None	None	None
Arwa Saidi	University of Florida—Director, Adult Congenital Heart Disease Program and Professor, Departments of Pediatric and Internal Medicine	None	None	None	None	None	None
Robert D. Ross	Children's Hospital of Michigan, Wayne State University School of Medicine—Director of Fellowship Programs and The Pulmonary Hypertension Program	None	None	None	None	None	None

ACCEPTED MANUSCRIPT

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 author's employment and reporting categories. To ensure complete transparency, authors' comprehensive healthcare-related disclosure information—including RWI not pertinent to this document—is available in an online data supplement (http://jaccjacc.acc.org/Clinical_Document/Ped_TS_TF6_Comprehensive_RWI_Supplement.pdf). 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.

APPENDIX 2. PEER REVIEWER RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—TASK FORCE 6: PEDIATRIC FELLOWSHIP TRAINING IN ADULT CONGENITAL HEART DISEASE

Name	Employment	Representation	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional/ Organizational or Other Financial Benefit	Expert Witness
Regina Lantin-Hermoso	Texas Children's Hospital	ACC ACPC Council	None	None	None	None	None	None
Carole Warnes	Mayo Clinic—Professor, Medicine	ACC BOT	None	None	None	None	None	None
Eric Williams	Indiana University School of Medicine—Professor (Cardiology) and Associate Dean; Indiana University Health, Cardiology Service Line Leader	ACC CMC Lead Reviewer	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 indicates American College of Cardiology; ACPC, Adult Congenital and Pediatric Cardiology; BOT, Board of Trustees; and CMC, Competency Management Committee.

ACCEPTED MANUSCRIPT

References

1. Warnes, C. A., Bhatt, A. B., Daniels, C. J., Gillam, L. D., and Stout, K. K. COCATS 4 task force 14: training in care of adult patients with congenital heart disease. J Am Coll Cardiol. 2015;

2. Warnes CA, Williams RG, Bashore TM, et al. ACC/AHA 2008 Guidelines for the Management of Adults with Congenital Heart Disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (writing committee to develop guidelines on the management of adults with congenital heart disease). Circulation 2008; 118:e714-e833.

3. Warnes CA, Liberthson R, Danielson GK, et al. Task force 1: the changing profile of congenital heart disease in adult life. J Am Coll Cardiol 2001; 37:1170-5.

4. Walsh EP, Cecchin F. Arrhythmias in adult patients with congenital heart disease. Circulation 2007; 115:534-45.

5. January CT, Wann LS, Alpert JS, et al. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. J Am Coll Cardiol 2014.

6. Book WM. Heart failure in the adult patient with congenital heart disease. J Card Fail 2005; 11:306-12.

7. Norozi K, Wessel A, Alpers V, et al. Incidence and risk distribution of heart failure in adolescents and adults with congenital heart disease after cardiac surgery. Am J Cardiol 2006; 97:1238-43.

8. Mahle WT, Todd K, Fyfe DA. Endothelial function following the Fontan operation. Am J Cardiol 2003; 91:1286-8.

9. Binotto MA, Maeda NY, Lopes AA. Altered endothelial function following the Fontan procedure. Cardiol Young 2008; 18:70-4.

10. Shaddy RE, Webb G. Applying heart failure guidelines to adult congenital heart disease patients. Expert Rev Cardiovasc Ther 2008; 6:165-74.

11. Bolger AP, Sharma R, Li W, et al. Neurohormonal activation and the chronic heart failure syndrome in adults with congenital heart disease. Circulation 2002; 106:92-9.

12. Clark JB, Pauliks LB, Myers JL, Undar A. Mechanical circulatory support for end-stage heart failure in repaired and palliated congenital heart disease. Curr Cardiol Rev 2011; 7:102-9.

13. Speziali G, Driscoll DJ, Danielson GK, et al. Cardiac transplantation for end-stage congenital heart defects: the Mayo Clinic experience. Mayo Cardiothoracic Transplant Team. Mayo Clin Proc 1998; 73:923-8.

14. Gatzoulis MA. The management of Eisenmenger syndrome in the modern treatment era: a case report. Eur Respir Rev 2011; 20:293-6.

15. Lowe BS, Therrien J, Ionescu-Ittu R, Pilote L, Martucci G, Marelli AJ. Diagnosis of pulmonary hypertension in the congenital heart disease adult population impact on outcomes. J Am Coll Cardiol 2011; 58:538-46.

16. Diller GP, Gatzoulis MA. Pulmonary vascular disease in adults with congenital heart disease. Circulation 2007; 115:1039-50.

17. Dimopoulos K, Inuzuka R, Goletto S, et al. Improved survival among patients with Eisenmenger syndrome receiving advanced therapy for pulmonary arterial hypertension. Circulation 2010; 121:20-5.

18. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th Edition ed. Washington, DC: 1994.

19. Williams NM, Owen MJ. Genetic abnormalities of chromosome 22 and the development of psychosis. Curr Psychiatry Rep 2004; 6:176-82.

20. Maron BJ, Zipes DP. Introduction: eligibility recommendations for competitive athletes with cardiovascular abnormalities-general considerations. J Am Coll Cardiol 2005; 45:1318-21.

21. Regitz-Zagrosek V, Blomstrom LC, Borghi C, et al. ESC Guidelines on the management of cardiovascular diseases during pregnancy: the Task Force on the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC). Eur Heart J 2011; 32:3147-97.

22. Siu SC, Sermer M, Colman JM, et al. Prospective multicenter study of pregnancy outcomes in women with heart disease. Circulation 2001; 104:515-21.

23. Drenthen W, Pieper PG, Roos-Hesselink JW, et al. Outcome of pregnancy in women with congenital heart disease: a literature review. J Am Coll Cardiol 2007; 49:2303-11.

24. Khairy P, Ouyang DW, Fernandes SM, Lee-Parritz A, Economy KE, Landzberg MJ. Pregnancy outcomes in women with congenital heart disease. Circulation 2006; 113:517-24.

25. Balint OH, Siu SC, Mason J, et al. Cardiac outcomes after pregnancy in women with congenital heart disease. Heart 2010; 96:1656-61.

26. James AH. Pregnancy-associated thrombosis. Hematology Am Soc Hematol Educ Program 2009;277-85.

27. Kovacs AH, Harrison JL, Colman JM, Sermer M, Siu SC, Silversides CK. Pregnancy and contraception in congenital heart disease: what women are not told. J Am Coll Cardiol 2008; 52:577-8.

28. Thorne S, MacGregor A, Nelson-Piercy C. Risks of contraception and pregnancy in heart disease. Heart 2006; 92:1520-5.

29. Drory Y, Kravetz S, Weingarten M. Comparison of sexual activity of women and men after a first acute myocardial infarction. Am J Cardiol 2000; 85:1283-7.

30. Cook SC, Arnott LM, Nicholson LM, Cook LR, Sparks EA, Daniels CJ. Erectile dysfunction in men with congenital heart disease. Am J Cardiol 2008; 102:1728-30.

31. Winter MM, Reisma C, Kedde H, et al. Sexuality in adult patients with congenital heart disease and their partners. Am J Cardiol 2010; 106:1163-8, 1168.

32. Vlachopoulos C, Ioakeimidis N, Terentes-Printzios D, Stefanadis C. The triad: erectile dysfunction--endothelial dysfunction--cardiovascular disease. Curr Pharm Des 2008; 14:3700-14.

33. Levine GN, Steinke EE, Bakaeen FG, et al. Sexual activity and cardiovascular disease: a scientific statement from the American Heart Association. Circulation 2012; 125:1058-72.

34. Sable C, Foster E, Uzark K, et al. Best practices in managing transition to adulthood for adolescents with congenital heart disease: the transition process and medical and psychosocial issues: a scientific statement from the American Heart Association. Circulation 2011; 123:1454-85.

35. Skorton DJ, Garson A, Jr., Allen HD, et al. Task force 5: adults with congenital heart disease: access to care. J Am Coll Cardiol 2001; 37:1193-8.

36. Moons P, Van DK, Marquet K, et al. Individual quality of life in adults with congenital heart disease: a paradigm shift. Eur Heart J 2005; 26:298-307.

37. Crossland DS, Jackson SP, Lyall R, Burn J, O'Sullivan JJ. Employment and advice regarding careers for adults with congenital heart disease. Cardiol Young 2005; 15:391-5.

38. Gutgesell HP, Gessner IH, Vetter VL, Yabek SM, Norton JB, Jr. Recreational and occupational recommendations for young patients with heart disease: a statement for physicians by the Committee on Congenital Cardiac Defects of the Council on Cardiovascular Disease in the Young, American Heart Association. Circulation 1986; 74:1195A-8A.