LIFELONG LEARNING STATEMENT

2020 ACC/HFSA/ISHLT Lifelong Learning Statement for Advanced Heart Failure and Transplant Cardiology Specialists

A Report of the ACC Competency Management Committee

WRITING COMMITTEE MEMBERS CLYDE W. YANCY, MD, MSc, MACC, FHFSA, CHAIR, MARK H. DRAZNER, MD, MSc, FACC, FHFSAVICE CHAIR, SAMUEL TRISTRAM COFFIN, MD, FACC, WILLIAM CORNWELL III, MD, SHASHANK DESAI, MD, MBA, FACC,* JOHN P. ERWIN III, MD, FACC, MAHAZARIN GINWALLA, MD, MS, FACC,† KAROL S. HARSHAW-ELLIS, ACNP-BC, DNP, FHFSA,* TAMARA HORWICH, MD, MS, FACC, MICHELLE KITTLESON, MD, PhD, FACC, ANURADHA LALA, MD, FACC, SABRA C. LEWSEY, MD, MPH, JOSEPH E. MARINE, MD, FACC, CINDY MARTIN, MD, KAREN MEEHAN, ACNS-BC, MSN, CVRN,† DAVID A. MORROW, MD, MPH, FACC, KELLY SCHLENDORF, MD, MHS,* JASON W. SMITH, MD,† GERIN R. STEVENS, MD, PhD, FACC, FHFSA, ACC COMPETENCY MANAGEMENT COMMITTEE JAMES A. ARRIGHI, MD, FACC, CHAIR, LISA A. MENDES, MD, FACC, CO-CHAIR, JESSE E. ADAMS III, MD, FACC,‡ JOHN E. BRUSH Jr, MD, FACC,‡ G. WILLIAM DEC Jr, MD, FACC, ALI DENKTAS, MD, FACC, SUSAN FERNANDES, LPD, PA-C, ROSARIO FREEMAN, MD, MS, FACC,‡ SANJEEV A. FRANCIS, MD, FACC, REBECCA T. HAHN, MD, FACC, JONATHAN L. HALPERIN, MD, FACC,§ SUSAN D. HOUSHOLDER-HUGHES, DNP, ACNS-BC, ANP-BC, FACC, SADIYA S. KHAN, MD, FACC, KYLE KLARICH, MD, FACC, C. HUIE LIN, MD, PhD, FACC, JOSEPH E. MARINE, MD, FACC, JOHN A. MCPHERSON, MD, FACC,‡ KHUSROW NIAZI, MBBS, FACC, THOMAS RYAN, MD, FACC, MICHAEL A. SOLOMON, MD, FACC, ROBERT L. SPICER, MD, FACC, MARTY TAM, MD,‡ ANDREW WANG, MD, FACC, FAHA, GABY WEISSMAN, MD, FACC, HOWARD H. WEITZ, MD, MACP, FACC, AND ERIC S. WILLIAMS, MD, MACC‖

Preamble

Since the publication of its first Core Cardiovascular Training Statement (COCATS) in 1995,[1] the American College of Cardiology (ACC) has defined the knowledge, experiences, skills, and behaviors expected of clinical cardiologists. Subsequent revisions have moved toward competency-based training based on the 6-domain competency structure promulgated by the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties and endorsed by the American Board of Internal Medicine (ABIM). The ACC has taken a similar approach to describe the aligned general cardiology lifelong learning competencies that practicing cardiologists are expected to maintain. Many hospital systems

The document was approved by the American College of Cardiology Lifelong Learning Oversight Committee, the Heart Failure Society of America Board of Trustees, and the International Society for Heart & Lung Transplantation Board of Trustees in August 2019. For the purpose of transparency, disclosure information for the Lifelong Learning Oversight Committee, the approval body of the convening organization of this document, is available at http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/clinical-document-approval.

The American College of Cardiology requests that this document be cited as follows: Yancy CW, Drazner MH, Coffin ST, Cornwell W III, Desai S, Erwin JP III, Ginwalla M, Harshaw-Ellis KS, Horwich T, Kittleson M, Lala A, Lewsey SC, Marine JE, Martin C, Meehan K, Morrow DA, Schlendorf K, Smith JW, Stevens GR. 2020 ACC/HFSA/ISHLT lifelong learning statement for advanced heart failure and transplant cardiology specialists: a report of the ACC Competency Management Committee. J Am Coll Cardiol 2020;26:254−269.

This article has been copublished in.

Copies: This document is available on the World Wide Web sites of the American College of Cardiology (www.acc.org), Heart Failure Society of America (www.hfsa.org), and International Society for Heart & Lung Transplantation (www.ishlt.org). For copies of this document, please contact Elsevier Inc. Reprint Department, fax (212) 633-3820, e-mail: reprints@elsevier.com.

*Heart Failure Society of America representative.

†International Society for Heart & Lung Transplantation representative.

‡Former Competency Management Committee member; member during this writing effort.

§Former Competency Management Committee co-chair; co-chair during this writing effort.

‖Former Competency Management Committee chair; chair during this writing effort.

1071-9164/$ - see front matter

https://doi.org/10.1016/j.cardfail.2020.01.008

now use the 6-domain structure as part of medical staff privileging, peer-review, and professional competence assessments.

Whereas COCATS and the associated Lifelong Learning Competencies for General Cardiologists[2] focus on general clinical cardiology, ACC Advanced Training Statements and associated Lifelong Learning Statements define selected competencies beyond those expected of all cardiologists that typically require training beyond a standard 3-year cardiovascular disease fellowship. This includes, but is not limited to, those disciplines for which there is an ABIM subspecialty certification. The Advanced Training Statements describe key experiences and outcomes necessary to acquire skills in a defined subspecialty area of cardiology in a structured training program. These are supplemented by Lifelong Learning Statements that address the commitment to sustaining and enriching competency over the span of a career.

The ACC Competency Management Committee oversees the development and periodic revision of the cardiovascular training and competency statements. A key feature of competency-based training and performance is an outcome-based evaluation system. Although specific areas of training may require a minimum number of procedures or duration of training to ensure adequate exposure to the range of clinical disorders, the objective assessment of proficiency and outcomes demonstrates the achievement of competency. Evaluation tools include examinations, direct observation, procedure logbooks, simulation, conference presentations, and multisource (360°) evaluations. For practicing physicians, these tools also include professional society registry or hospital quality data, peer-review processes, and patient satisfaction surveys. A second feature of competency-based training is recognition that learners gain competency at different rates. For multiyear training programs, assessment of representative curricular milestones during training can identify learners or areas that require additional focused attention.

The recommendations in ACC Cardiovascular Training and Lifelong Learning Statements are based on available evidence and, where evidence is lacking, reflect consensus expert opinion. The writing committees are broad-based and typically include early-, mid-, and later-career specialists; general cardiology and subspecialty training directors; practicing cardiologists; people working in institutions of various sizes and in diverse practice settings across the United States; and nonphysician members of the cardiovascular care team. All documents undergo a rigorous process of peer review and public comment. Recommendations are intended to guide the assessment of competence of cardiovascular care providers beginning independent practice as well as those undergoing periodic review to ensure that competence is maintained.

This Lifelong Learning Statement addresses the competencies required of advanced heart failure and transplant cardiology (AHFTC) specialists and complements formal AHFTC fellowship training. The Statement delineates the core competencies reasonably expected of all individuals trained at this level. Furthermore, the Statement identifies additional, selected competencies of AHFTC specialists, the majority of which would be expected of all AHFTC specialists at completion of their formal advanced training, but some of which may no longer be applicable to certain AHFTC specialists later in their career. We recognize that some AHFTC specialists who care for patient populations who have not undergone implantation of durable left ventricular assist devices or cardiac transplantation exemplify this situation. This Statement also provides examples of appropriate measures for assessing competence in the context of lifelong learning.

The work of the writing committee was supported exclusively by the ACC without commercial support. Writing committee members volunteered their time to this effort. Conference calls of the writing committee were confidential and attended only by committee members. To avoid actual, potential, or perceived conflict of interest resulting from relationships with industry (RWI) or other entities of members of the Writing Committee or peer reviewers of the document, each individual was required to disclose all current healthcare-related relationships as well as those existing 12 months before initiation of the writing effort. The ACC Competency Management Committee reviewed these disclosures to identify products (currently marketed or under development) pertinent to the document topic. Based on this information, the writing committee was selected to ensure that the chair and a majority of members had no relevant RWI. Authors with relevant RWI were not permitted to vote on recommendations or curricular requirements to which their RWI might apply. RWI was reviewed at the start of all meetings and conference calls and updated as changes occurred. Relevant RWI for authors is disclosed in Appendix 1. To ensure transparency, comprehensive RWI for authors, including RWI not pertinent to this document, is posted online at http://jaccjacc.acc.org/Clinical_Document/AHFTC_LLS_Author_Comprehensive_Disclosure_Table.pdf. Employment information and affiliations of the peer reviewers are shown in Appendix 2. There are no RWI restrictions for participation in peer review, in the interest of encouraging comments from a variety of constituencies to ensure that broad viewpoints inform final document content. Reviewers are required, however, to disclose all healthcare-related RWI and other entities, and their disclosure information is posted online at http://jaccjacc.acc.org/Clinical_Document/AHFTC_LLS_PEER_REVIEWER_Comprehensive_Disclosure_Table.pdf. Disclosure information for the ACC Competency Management Committee is available online at http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/guidelines-and-documents-task-forces, and the ACC disclosure policy for document development is posted at http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/relationships-with-industry-policy.

James A. Arrighi, MD, FACC
Chair, ACC Competency Management Committee
Lisa A. Mendes, MD, FACC
Co-Chair, ACC Competency Management Committee

1. Introduction

1.1. Document Development Process

1.1.1. Writing Committee Organization. The writing committee consisted of 19 members from across the United

States representing the ACC, the Heart Failure Society of America (HFSA), and the International Society for Heart & Lung Transplantation (ISHLT), identified because they fit into ≥1 of the following roles/categories: AHFTC training program directors; experts at early, mid-, and later-career stages; general cardiologists; AHFTC specialists representing both the academic and community-based practice settings as well as small, medium, and large institutions; specialists in all aspects of AHFTC, including mechanical circulatory support, cardiac resynchronization therapy, and pulmonary arterial hypertension; specialists in cardiothoracic surgery, critical care cardiology, electrophysiology, and adult congenital heart disease; members who have worked with ABIM; physicians experienced in defining and applying training standards according to the 6 general competency domains promulgated by the ACGME and the American Board of Medical Specialties and endorsed by the ABIM; AHFTC fellows-in-training; ventricular assist device transplant coordinators; and advanced practice nurses. The writing committee met the College's disclosure requirements for RWI as described in the Preamble.

1.1.2. Document Development and Approval. The writing committee chairs, Competency Management Committee chairs, and Competency Management Committee liaison convened to plan the writing effort, select authors on the basis of the criteria specified in Section 1.1.1, and draft the preliminary competency table for writing committee review. Authors of the published 2017 AHFTC Advanced Training Statement were invited to provide initial feedback on the competency table prior to the launch of the new writing effort. The writing committee convened by conference call and e-mail to finalize the document outline, develop the initial draft, revise the draft on the basis of committee feedback, and ultimately approve the document for external peer review.

The document was reviewed by 9 official representatives from the ACC, HFSA, and ISHLT, as well as by 21 additional content reviewers (see Appendix 2). It was simultaneously posted for public comment on the website of the American College of Cardiology from February 21, 2019, to March 25, 2019. A total of 210 comments were submitted on the document. Comments were reviewed and addressed by the writing committee. A member of the ACC Competency Management Committee served as lead reviewer to ensure a fair and balanced peer review resolution process. Both the writing committee and the ACC Competency Management Committee approved the final document to be sent for organizational approval. The governing bodies of the ACC, HFSA, and ISHLT approved the document for publication. This document is considered current until the ACC Competency Management Committee revises or withdraws it from publication.

1.2. Background and Scope

In 2010, the ACC began an ambitious initiative to delineate: 1) the core clinical competencies essential for trainees to attain during a 3-year cardiovascular fellowship (COCATS 4)[3]; and 2) the aligned competencies that patients and accrediting bodies can reasonably expect clinical cardiologists in practice to acquire, maintain, or enhance through lifelong learning throughout their career.[2] Key features of this outcomes-based curriculum include the 6-domain structure promulgated by the ACGME and the American Board of Medical Specialties and endorsed by the ABIM. The cardiovascular competencies provide a structure for the ACC learning pathways and underpin all ACC educational activities.

The lifelong learning competencies for general cardiologists were published in 2016 and incorporated the new curricular competency format aligned with the COCATS 4 training milestones.[2] Although the COCATS 4 and lifelong learning competencies are similar, they are distinct, reflecting the impact of practice focus, experience, and additional education and training on expectations of competency. Similarly, an advanced training statement on AHFTC, germane to fellowship training, was published in 2017,[4] whereas this current document now represents the corresponding lifelong learning competencies for AHFTC specialists in practice based on their specific training, experience, and practice focus. The aggregated lifelong learning competencies collectively underlie the Entrustable Professional Activities that patients and the public can reasonably expect all competent clinical cardiologists, including AHFTC specialists, to be able to perform (Table 1).

1.2.1. AHFTC Lifelong Learning Competencies. The lifelong learning competencies for AHFTC are organized using the 6 domains promulgated by ACGME and the American Board of Medical Specialties and endorsed by the ABIM (Table 2) and are outlined in Section 1. Section 2 focuses on clinical competencies. Section 3 focuses on leadership and administrative competencies that pertain to all cardiovascular specialists, including AHFTC specialists.

Table 1. Entrustable Professional Activities for Specialists in Cardiovascular Disease

- **Cardiovascular Consultation—**evaluate, diagnose, and develop treatment plans for patients with known or suspected cardiovascular disease, or who are at risk of developing cardiovascular disease.
- **Acute Cardiac Care—**manage patients with acute cardiac conditions.
- **Chronic Cardiovascular Disease Management—**manage patients with chronic cardiovascular diseases.
- **Cardiovascular Testing—**appropriately utilize cardiovascular diagnostic testing.
- **Disease Prevention and Risk Factor Control—**implement disease prevention and risk factor control measures, addressing comorbidities.
- **Team-Based Care—**work effectively to promote and coordinate interdisciplinary, patient-centered care.
- **Lifelong Learning—**engage in lifelong learning to maintain and enhance knowledge and skills.

Reproduced from Halperin et al.[5]

Table 2. ACGME Core Competencies

- **Patient Care** that is compassionate, appropriate, and effective for treating health problems and promoting health.
- **Medical Knowledge** about established and evolving biomedical, clinical, and cognate (e.g., epidemiological and social-behavioral) sciences and the application of this knowledge to patient care.
- **Practice-Based Learning and Improvement** that involves investigation and evaluation of their own patient care, self-appraisal, and assimilation of scientific evidence and improvements in patient care.
- **Interpersonal and Communication Skills** that result in effective information exchange and teaming with patients, their families, and other health professionals.
- **Professionalism** as manifested by a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.
- **Systems-Based Practice** as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

These minimum general competencies were endorsed by the ACGME in February 1999 (www.acgme.org). All Residency Review Committees and Institutional Review Committees were to include this minimum language in their respective Program and Institutional Requirements by June of 2001. The definitions are available at Kavic.[6]

ACGME = Accreditation Council for Graduate Medical Education.

1.2.2. Research and Scholarly Activity. Scholarly activity and clinical research are important in lifelong learning and professional competency. All physicians should have the skills to assess new research findings and appropriately incorporate new diagnostic and treatment modalities in patient care. In addition, physicians should utilize a scholarly approach to evaluate evidence, address clinical questions, and enhance outcomes through literature review, including at the point of care. They should use a systematic approach to assess high-quality evidence from a variety of sources to apply a patient-centered approach to optimizing care and outcomes across all settings. Physicians should maintain and enhance knowledge through regular reading of peer-reviewed journals and other sources of reliable information, and through attending scientific meetings and professional congresses. Referral of patients for participation in well-designed clinical trials is encouraged for both academic and nonacademic cardiologists.

2. Clinical Competencies

Table 3 encompasses both the medical knowledge competencies and patient care and procedural skill competencies specifically related to AHFTC. Table 4 specifies a common set of professional behavior competencies that fall under the ACGME competency domains of systems-based practice, practice-based learning and improvement, interpersonal and communication skills, and professionalism. Although these competencies are relevant to all clinical cardiovascular disease specialists, they should be interpreted within the context of AHFTC practice.

2.1. Distinction Between Competencies Expected of All AHFTC Specialists and Those Required Based on the Focus of Practice

Table 3 distinguishes competency components expected of all AHFTC specialists (left column) from those expected of selected AHFTC specialists on the basis of background, specialized knowledge, skills, experience, and practice focus (right column). This distinction is particularly relevant to the patient care competencies and recognizes diversity in the focus of practice of AHFTC specialists. Some physicians may specialize in a particular aspect of AHFTC, such as mechanical circulatory support or cardiac transplantation, while others may adopt a practice focused on patients with chronic heart failure with a lesser need for advanced heart failure interventions. These distinctions may be magnified later in specialists' careers with divergence of practice focus and can be contrasted with the broader range of core competencies representing the breadth of the AHFTC field that is expected of an AHFTC trainee upon completion of fellowship, as outlined in the prior Advanced Training Statement. However, if an AHFTC specialist cares for patients with left ventricular assist devices or those who have undergone heart transplantation, it would be expected that they maintain all such relevant competencies.

3. Leadership and Administrative Competencies

In addition to clinical competency, AHFTC specialists are expected to function effectively as leaders in allied efforts to ensure high-quality care and promote individual and population health. These skills are particularly necessary as a greater reliance on team management begins to define the care of patients with heart failure. Some of these activities and attributes fall outside the realm of clinical knowledge and skill and instead involve administrative roles in clinical practice, hospitals, health systems, professional societies, or other organizations. It is important for AHFTC specialists to exercise cultural sensitivity in the critical decision making affecting the quality and duration of life in varied populations affected by heart failure. Specific competencies expected of all general cardiologists and cardiovascular specialists, including those with roles in administrative, managerial, or advocacy positions, are delineated in Table 24 of the 2016 ACC Lifelong Learning Competencies for General Cardiologists.[2]

4. Maintenance of Competence and Assessment Tools

Continuing practice of AHFTC requires ongoing maintenance of competency beyond original training. The requirements for training as a specialist in AHFTC are delineated in the 2017 Advanced Training Statement on AHFTC,

Table 3. Lifelong Learning Competencies for AHFTC Specialists

MEDICAL KNOWLEDGE	All AHFTC Specialists	Selected AHFTC Specialists Based on Practice Focus
Heart Failure		
Pathophysiology		
1. Know the principles of excitation-contraction coupling and the components of the contractile apparatus of the cardiomyocyte.	X	
2. Know important hemodynamic principles related to heart failure, including normal cardiac physiology, contractility, preload, afterload, and interpretation of pressure-volume loops and ventricular performance (Frank-Starling) curves.	X	
3. Know the pathophysiology of heart failure, including concepts such as right and left ventricular remodeling, neurohormonal activation, fetal gene expression, wall stress, signaling pathways (calcium, beta-adrenergic signaling, and nitric oxide), myocardial energetics, metabolic derangements, electrical and mechanical dyssynchrony, and the role of the extracellular matrix.	X	
4. Know common genetic underpinnings of cardiomyopathies (including dilated, infiltrative, hypertrophic, and arrhythmogenic) their clinical phenotypes, and the role of genetic screening, counseling, and testing for patients and their families.	X	
5. Know the epidemiology and pathophysiology of acute heart failure, including de novo and acute-on-chronic heart failure.	X	
6. Know the potential contribution of arrhythmias to development of heart failure and/or decompensation and appropriate pharmacological and ablation options for therapy.	X	
7. Know the pathophysiology, clinical presentation, typical comorbidities, differential diagnosis, and management of heart failure with preserved ejection fraction.	X	
8. Know the pathophysiology, clinical presentation, diagnostic criteria, genetic basis, methods of risk stratification, and management of patients with hypertrophic cardiomyopathy.	X	
9. Know the pathophysiology, clinical presentation, diagnostic criteria, methods of risk stratification, and management of patients with infiltrative cardiomyopathies, including sarcoid, amyloid, and hemochromatosis.	X	
10. Know the common cardiovascular complications associated with chemotherapeutic and cancer-related therapies, including hypertension, arrhythmias, myocarditis, and heart failure.	X	
11. Know the pathophysiology of cardiac dysfunction associated with cirrhosis.	X	
12. Know the pathophysiology of cardiac dysfunction associated with single ventricle syndromes, failed Fontan operations, and Eisenmenger's syndrome.		X
Epidemiology and Nomenclature		
13. Know the epidemiology, natural history, and risk determinants of right and left ventricular dysfunction, ventricular hypertrophy, and heart failure (both with reduced and preserved ejection fraction), including incidence and prevalence in the general population and also in women, the elderly, and minorities.	X	
14. Know the classification methods of heart failure including the American College of Cardiology/American Heart Association stages, New York Heart Association classes, and Interagency *Registry* for Mechanically Assisted Circulatory Support (INTERMACS) profiles (where applicable).	X	
15. Know the epidemiology and pathophysiology of cardiorenal syndrome and strategies for management.	X	
Presentation and Evaluation		
16. Know the distinguishing features of and appropriate diagnostic studies for specific etiologies of heart failure, including coronary artery disease, valvular heart disease, hypertension, human immunodeficiency virus, myocarditis, infiltrative processes (e.g., amyloid, sarcoid), toxins (e.g., illicit drugs), chemotherapy, pregnancy, congenital heart disease, radiation, pericardial processes, endocrinopathies, high-output states, stress cardiomyopathy (i.e., Takotsubo), and inherited syndromes.	X	
17. Know typical and atypical clinical presentations of patients with advanced heart failure (e.g., cachexia, early satiety, worsening renal function, cognitive impairment, medication intolerance, recurrent implantable cardioverter-defibrillator shock), the prognosis associated with different presentations (e.g., congestion versus poor perfusion), their management, and the importance of recurrent hospitalizations.	X	
18. Know the risks of arterial and venous thromboembolic complications and indications for thromboembolic prophylaxis and treatment in patients with heart failure.	X	
19. Know the indications for percutaneous and surgical intervention for aortic valve disease in patients with heart failure.	X	
20. Know the indications for percutaneous and surgical intervention for mitral valve disease in patients with heart failure.	X	
21. Know the standard risk assessment methods/tools (e.g., 6-minute walk testing, cardiopulmonary stress testing, invasive hemodynamic testing) used to stratify patients with heart failure, including limitations and optimal role in evaluating the need for advanced therapies.	X	
22. Know the indications for and role of invasive cardiopulmonary exercise testing in patients with unexplained dyspnea.	X	
23. Know the roles of various formats of noninvasive coronary imaging and ischemia and viability testing in patients with heart failure.	X	
24. Know the role of invasive coronary angiography in the diagnosis and management of patients with heart failure.	X	
25. Know the indications for, role of, and complications related to invasive hemodynamic assessment in patients with acute decompensated and chronic heart failure, including evaluation for advanced therapies.	X	
	X	

(*continued*)

Table 3 (*Continued*)

MEDICAL KNOWLEDGE	All AHFTC Specialists	Selected AHFTC Specialists Based on Practice Focus
26. Know the indications for genetic testing, imaging, and endomyocardial biopsy for the evaluation of new-onset cardiomyopathy and the specific indications for imaging and endomyocardial biopsy for myocarditis and infiltrative cardiomyopathies.		
27. Know the utility of noninvasive imaging in the assessment of patients with myocarditis, cardiomyopathy, and heart failure.	X	
28. Know the distinguishing features of and appropriate diagnostic studies for cancer-related causes of heart failure, including risk factors, natural history, risk of chest radiation therapy, cardiovascular imaging findings, and strategies for prevention and treatment.	X	
29. Know the distinguishing features of and appropriate diagnostic studies for heart failure in patients with simple adult congenital heart disease (i.e., atrial septal defects, ventricular septal defects, patent ductus arteriosus, pulmonary stenosis, bicuspid aortic valve, and coarctation), including usual anatomical basis and surgical correction, risk factors, natural history, and strategies for treatment.	X	
30. Know the strengths and limitations of common quality-of-life assessment tools used in patients with heart failure.	X	
31. Know the definition and pathophysiology of frailty; tools available for frailty assessment; and the influence of frailty on the diagnosis, prognosis, and candidacy for advanced therapies in patients with heart failure.	X	
Management		
32. Know the pharmacology and practical use of common inotropes, vasopressors, and vasodilators for the management of low-output heart failure.	X	
33. Know the methods of risk stratification and management of patients with infiltrative cardiomyopathies, including amyloid, sarcoid, and hemochromatosis.	X	
34. Know the indications for and the role of assays for natriuretic peptide and other biomarkers in the prevention, risk assessment, and management of patients with heart failure.	X	
35. Know which lifestyle behaviors (e.g., physical activity, diet, alcohol use) contribute to the development of heart failure or clinical instability in patients with established heart failure.	X	
36. Know which comorbidities (e.g., obesity, obstructive sleep apnea, depression, anemia, diabetes, hypertension, thyroid dysfunction, renal failure, tachyarrhythmias) contribute to the development of heart failure or clinical instability in patients with established heart failure, as well as potential management options for such comorbid conditions.	X	
37. Know the indications for and roles of cardiac implantable electronic device therapy in patients with heart failure, including implantable cardioverter defibrillators, pacemakers, and cardiac resynchronization devices.	X	
38. Know the role of implantable technology to facilitate remote hemodynamic and arrhythmia monitoring of patients with heart failure (e.g., pulmonary artery monitoring and cardiac implantable electronic devices, respectively).	X	
39. Know the roles of palliative care and hospice in patients with heart failure and the indications for referral.	X	
40. Know the role of palliative inotropes in patients with end-stage heart failure who are not candidates for advanced therapies.	X	
41. Know the roles of exercise training and cardiac rehabilitation in patients with heart failure.	X	
42. Know the recommendations for contraceptive management, preconception evaluation, and heart failure management in pregnancy in collaboration with specialists skilled in high-risk pregnancy.	X	
Pulmonary Hypertension		
43. Know the epidemiology, risk factors, prognostic factors, pathophysiology, and natural history of pulmonary hypertension.	X	
44. Know the classification, etiologies, and appropriate treatment of each type of World Health Organization pulmonary hypertension.	X	
45. Know the role of invasive hemodynamic assessment, including characterization of pre- and post-capillary components in patients with pulmonary hypertension.	X	
46. Know the indications to perform vasoreactivity1 testing in pulmonary arterial hypertension and pulmonary hypertension due to left heart disease undergoing transplant evaluations.	X	
47. Know the role of provocative maneuvers (fluid loading and/or exercise), as needed, to assess and diagnose patients with pulmonary hypertension.	X	
48. Know the classes of medications available to treat pulmonary hypertension and their use alone and in combination, including management of side effects.	X	
49. Know the role of inhaled and intravenous agents in selected patients with pulmonary hypertension and acute right ventricular failure.		X
50. Know the roles of balloon atrial septostomy, balloon pulmonary angioplasty, thromboendarterectomy, and lung transplantation in patients with pulmonary arterial hypertension.		X
51. Know the roles of 6-minute walk and cardiopulmonary testing to assess and manage patients with pulmonary hypertension.	X	
52. Know the indications for patient referral to a specialized pulmonary hypertension center.	X	
53. Know the recommendations for contraceptive management, preconception evaluation, and pulmonary hypertension management in pregnancy in collaboration with specialists skilled in high-risk pregnancy.		X

(*continued*)

Table 3 (*Continued*)

MEDICAL KNOWLEDGE	All AHFTC Specialists	Selected AHFTC Specialists Based on Practice Focus
Mechanical Circulatory Support		
54. Know the basic engineering and design of temporary and durable ventricular assist devices, waveform analysis, and implications of mechanical circulatory support for hemocompatibility and hemodynamics.	X	
55. Know the indications and contraindications for both temporary and durable mechanical circulatory support.	X	
56. Know the expected morbidity and mortality following use of both temporary and durable mechanical circulatory support.	X	
57. Know clinical determinants favoring mechanical circulatory support versus transplantation as durable strategies.	X	
58. Know the prevailing anticoagulation and antiplatelet strategies for patients with ventricular assist devices.	X	
59. Know the management principles for patients with cardiogenic shock.	X	
60. Know the management principles and potential complications of extracorporeal membrane oxygenation.		X
61. Know the anatomic, surgical, and comorbid conditions that may impact mechanical circulatory support strategies (e.g., in adult patients with congenital heart disease, aortic regurgitation, prosthetic valves, and multiple open-chest procedures).		X
62. Know intraoperative and early and late postoperative complications of durable mechanical circulatory support and their management.		X
63. Know the typical presentations of and initial management strategies for supraventricular and ventricular arrhythmias in patients with durable ventricular assist devices.		X
64. Know the risk factors for and typical presentations and initial management of common longer-term complications of durable ventricular assist devices, including right heart failure, stroke, driveline infections, device thrombosis, hemolysis, gastrointestinal bleeding, and aortic insufficiency.	X	
65. Know the pathophysiology and testing for bleeding diatheses and how they can affect mechanical circulatory support management.		X
66. Know the management of temporary and durable mechanical circulatory support devices, in conjunction with a multidisciplinary care team, for patients who are terminally ill and need comfort care.	X	
67. Know the recommendations for contraceptive management, preconception evaluation, and management of mechanical circulatory support in pregnancy in collaboration with specialists skilled in high-risk pregnancy.		X
Cardiac Transplantation		
68. Know the indications and contraindications (both relative and absolute) for heart transplantation.	X	
69. Know current United Network for Organ Sharing allocation listing policies for heart transplantation.	X	
70. Know the anatomic, surgical, immunological, and comorbid conditions that may impact transplant surgery planning and outcomes in potential heart transplant recipients.		X
71. Know the expected survival rates following heart transplantation.	X	
72. Know the role and expected survival rates of dual-organ (e.g., heart-lung, heart-kidney, heart-liver) transplantation.	X	
73. Know the principles of immunology that pertain to heart transplantation, including sensitization and histocompatibility.	X	
74. Know and understand the efficacy, risks, and limitations of currently available methods for desensitization of patients awaiting heart transplantation.		X
75. Know the anatomic, surgical, and comorbid conditions that may impact transplant surgery planning and outcomes in adult patients with congenital heart disease, necessitating evaluation at a transplant center with expertise in these conditions.		X
76. Know the factors used to assess the suitability of a potential donor heart, especially in the context of matching to the appropriate recipient.		X
77. Know the process by which the heart procurement team interacts with teams procuring other organs from donors.		X
78. Know the intraoperative and early and late postoperative complications of heart transplantation.		X
79. Know the clinical presentations of, as well as risk factors, diagnostic strategies, and treatment for, post-transplant arrhythmias.		X
80. Know the pharmacology of immunosuppressant therapy, including an understanding of dose titration to therapeutic trough levels, drug−drug and diet−drug interactions that may affect trough levels, and identification and management of adverse reactions related to immunosuppressants.		X
81. Know the impact of cardiac denervation on cardiac physiology, including response to exercise and pharmacological agents and clinical manifestations of myocardial ischemia.	X	
82. Know the risk factors, clinical presentation, International Society for Heart & Lung Transplantation grading system, and strengths and limitations of diagnostic tools for cardiac allograft vasculopathy.	X	
83. Know the clinical presentations of, as well as the diagnostic strategies and initial treatment for, primary graft failure and hyperacute, acute cellular, and antibody-mediated rejection.	X	
84. Know the strengths and limitations of strategies used to detect and monitor transplant rejection.	X	
85. Know the indications and contraindications (both relative and absolute) for cardiac retransplantation.		X
86. Know common post-transplant complications and usual comorbidities, including hypertension, diabetes, malignancy, renal dysfunction, infection, obesity, and endocrinological and neurological sequelae.	X	
87. Know the clinical presentation for common opportunistic infections in cardiac transplant recipients, as well as the potential for donor transmission of infectious organisms.	X	
88. Know the roles of exercise training and cardiac rehabilitation in patients following heart transplantation.	X	

(*continued*)

Table 3 (*Continued*)

MEDICAL KNOWLEDGE	All AHFTC Specialists	Selected AHFTC Specialists Based on Practice Focus
89. Know the lifestyle interventions needed for post-transplant patients, including awareness of increased risk of skin and respiratory infections; importance of food, animal, and water safety; skin cancer prevention; and avoidance of tobacco, alcohol, and substance abuse.	X	
90. Know the recommendations for contraceptive management, preconception evaluation, and management of cardiac transplantation in pregnancy in collaboration with specialists skilled in high-risk pregnancy.		X
PATIENT CARE AND PROCEDURAL SKILLS		
Heart Failure		
1. Skill to optimize therapeutic regimens on the basis of guideline-directed pharmacological and device-based therapies in patients with heart failure with reduced ejection fraction.	X	
2. Skill to optimize evidence-based therapeutic regimens in patients with heart failure with preserved ejection fraction.	X	
3. Skills to estimate jugular venous pressure by clinical examination and recognize other signs and symptoms of congestion.	X	
4. Skill to optimize a diuretic regimen in both inpatient and outpatient settings.	X	
5. Skills to decide whether and when to hospitalize patients with heart failure and to triage to the appropriate level of hospital care and/or hospital system.	X	
6. Skill to stabilize hospitalized patients with decompensated heart failure, including optimization of evidence-based medical therapy and facilitation of patient education and transition of care.	X	
7. Skill to assess left ventricular systolic and diastolic function using multimodality imaging in patients with heart failure.	X	
8. Skill to select individualized diagnostic testing for patients with a new diagnosis of heart failure.	X	
9. Skills to initiate genetic testing of patients with cardiomyopathy and implement screening of family members at risk for cardiomyopathy in collaboration with genetic counselors and centers.	X	
10. Skills to recognize and stabilize patients with cardiogenic shock, including effective participation in a multidisciplinary shock team, when available.	X	
11. Skills to recognize and stabilize patients in noncardiogenic shock with a history of cardiomyopathy or heart failure.	X	
12. Skill to perform right heart catheterization in patients with heart failure.		X
13. Skill to interpret findings from right heart catheterization in patients with heart failure.	X	
14. Skill to perform an endomyocardial biopsy in patients with heart failure, when indicated.		X
15. Skills to assess risk of patients with heart failure undergoing cardiac or noncardiac surgery and to manage their hemodynamic status perioperatively.	X	
16. Skills to perform and interpret cardiopulmonary stress testing.	X	
17. Skills to initiate palliative and supportive care and to address symptoms and goals of care for patients with advanced heart failure across the care continuum.	X	
18. Skills to perform initial evaluation and stabilization of heart failure patients with supraventricular and ventricular arrhythmias in both acute and chronic settings.	X	
19. Skills to manage heart failure patients with arrhythmias and to identify candidates for ablation procedures (including those who require mechanical circulatory support) in collaboration with cardiac electrophysiologists.	X	
20. Skill to determine whether a percutaneous or surgical valve intervention indicated for functional mitral regurgitation is necessary for patients with heart failure after optimization of guideline-directed medical therapy in collaboration with interventional cardiologists and cardiac surgeons.	X	
21. Skill to determine whether a percutaneous or surgical valve intervention is necessary for patients with heart failure and critical aortic stenosis in collaboration with interventional cardiologists and cardiac surgeons.	X	
22. Skills to assess and manage patients with heart failure complicating adult congenital heart disease, including determining when to refer for mechanical circulatory support or cardiac transplantation, in collaboration with experts in adult congenital heart disease.	X	
23. Skill to determine the indications for coronary revascularization, including percutaneous coronary intervention and coronary artery bypass graft surgery, in patients with ischemic heart disease.	X	
24. Skills to understand the interrogation of implantable cardioverter-defibrillators, cardiac resynchronization pacemakers, and cardiac resynchronization-defibrillator devices in patients with cardiomyopathy and/or heart failure to determine the burden of arrhythmias, diagnostic information, and basic device functionality.	X	
25. Skills to determine when heart failure patients are inotrope dependent and to manage them in the outpatient setting.	X	
26. Skill to manage heart failure in pregnant patients with a cardiomyopathy and/or heart failure in collaboration with specialists skilled in high-risk pregnancy.	X	
27. Skills to educate patients with heart failure about warning signs that signify or predict clinical instability and to help them develop action plans in the event warning signs appear.	X	
28. Skills to manage immunosuppressive agents in autoimmune or inflammatory cardiomyopathies (e.g., sarcoidosis, giant cell myocarditis) as well as to assess treatment efficacy.		X

(*continued*)

Table 3 (*Continued*)

PATIENT CARE AND PROCEDURAL SKILLS		
29. Skill to manage cardiac amyloidosis complicated by heart failure.		X
30. Skills to assess and manage heart failure in patients receiving chemotherapy or other cancer-related therapies in collaboration with specialists in cardio-oncology.	X	
Pulmonary Hypertension		
31. Skill to evaluate patients with pulmonary hypertension to determine etiology.	X	
32. Skill to interpret noninvasive test results, including functional capacity assessment, imaging studies, and biomarkers that may provide diagnostic and prognostic information in patients with pulmonary arterial hypertension.		X
33. Skills to recommend the initial pharmacological regimen for patients with pulmonary arterial hypertension and to adjust therapy on the basis of response, including serial assessments of functional capacity, right ventricular function, and right-sided hemodynamics.		X
34. Skill to manage patients with pulmonary arterial hypertension on continuous prostanoid and other vasoactive infusion therapies in the outpatient setting.		X
35. Skills to perform right heart catheterization and to integrate these data into the management of patients with pulmonary hypertension.		X
36. Skills to assess the risk of patients with pulmonary hypertension and/or right heart failure undergoing conscious sedation or general anesthesia and to manage their hemodynamic status periprocedurally or perioperatively.		X
37. Skills to educate patients with pulmonary hypertension about warning signs that signify or predict clinical instability and to help them develop action plans in the event warning signs appear.		X
38. Skill to detect clinical deterioration in patients with pulmonary hypertension, including the determination of whether hospitalization is necessary.	X	
39. Skill to stabilize patients with acute right ventricular failure in the setting of pulmonary hypertension.		X
40. Skill to determine whether referral for lung transplantation is necessary for patients with pulmonary arterial hypertension.		X
Mechanical Circulatory Support		
41. Skill to identify appropriate options for temporary hemodynamic support for patients in cardiogenic shock.	X	
42. Skill to identify appropriate candidates for consideration of a temporary or durable ventricular assist device.	X	
43. Skills to interrogate, interpret, and manipulate device parameters in patients with temporary (including extracorporeal membrane oxygenation) and durable hemodynamic assist devices.		X
44. Skill to recognize the indications for total artificial heart or right ventricular assist device rather than left ventricular assist device alone.		X
45. Skill to modulate the settings of mechanical circulatory support devices using imaging, hemodynamic, and clinical data.		X
46. Skills to select and interpret noninvasive and invasive data to evaluate patients with temporary and durable ventricular assist devices (e.g., ramp study, aortic valve opening, or right ventricular assessment).		X
47. Skills to identify and manage right heart failure in patients with left ventricular assist devices.		X
48. Skill to manage long-term durable mechanical circulatory support in the outpatient setting.		X
49. Skill to recognize complications of temporary and durable mechanical circulatory support.	X	
50. Skill to manage complications of temporary and durable mechanical circulatory support.		X
51. Skill to oversee resuscitative efforts in patients with durable ventricular assist devices and cardiac arrest.		X
52. Skills to assess for cardiac recovery in patients with left ventricular assist devices and to determine candidates who may no longer need mechanical support.		X
53. Skill to determine whether and when to hospitalize patients with durable ventricular assist devices.	X	
54. Skill to optimize hemodynamic management during invasive procedures or noncardiac surgery in patients with continuous flow or durable ventricular assist devices in collaboration with anesthesiologists and procedural specialists.		X
55. Skill to work effectively with the multidisciplinary team in the evaluation and selection of candidates for durable mechanical circulatory support.	X	
Cardiac Transplantation		
56. Skill to determine whether and when patients warrant evaluation for cardiac transplantation.	X	
57. Skills to interpret a complete transplant evaluation and to determine if a transplant listing is warranted and at what status.		X
58. Skill to recognize when dual-organ transplantation (heart-lung, heart-liver, heart-kidney) may be indicated.		X
59. Skill to recognize irreversible pulmonary hypertension that precludes isolated heart transplantation.		X
60. Skill to assess the suitability of a donor heart for transplantation in a potential recipient.		X
61. Skill to work effectively with the multidisciplinary team in the evaluation and selection of candidates for cardiac transplantation.	X	
62. Skill to adjust immunosuppressant therapy to minimize the risk of rejection while balancing competing risks of infection, malignancy, renal failure, and other toxicities.		X
63. Skill to assess a heart transplant recipient's reactive antibody panel, preformed and post-transplant antihuman leukocyte antigen antibodies, and immunological compatibility with a donor heart in collaboration with immunology laboratory specialists.		X

(*continued*)

Table 3 (*Continued*)

PATIENT CARE AND PROCEDURAL SKILLS		
64. Skill to manage heart transplant recipients in the immediate post-transplant period, including those with complications, in conjunction with a multidisciplinary team.		
65. Skill to determine whether and when illness in heart transplant recipients requires hospitalization.	X	
66. Skills to interpret with a pathologist the findings of endomyocardial biopsies to determine the need for treatment of acute cellular or antibody-mediated rejection and oversee treatment.		X
67. Skill to manage common comorbidities and complications following heart transplantation, including hypertension, dyslipidemia, renal insufficiency, infection, depression, nonadherence, and cancer in collaboration with other members of a multidisciplinary medical team.	X	
68. Skill to prevent, recognize, and treat transplant vasculopathy in collaboration with invasive and interventional cardiologists.		X
69. Skill to interpret noninvasive test results, including echocardiograms, cardiac magnetic resonance imaging, gene expression profiling, and other biomarkers to evaluate for post-transplant heart dysfunction (e.g., rejection in heart transplant recipients).		X
70. Skill to perform endomyocardial biopsy to assess for transplant rejection.		X
71. Skill to use prophylactic measures to prevent or minimize risk of infection in heart transplant recipients in collaboration with infectious disease specialists.		X
72. Skill to provide recommendations regarding immunizations, health maintenance, dental care, and noncardiac surgery in patients before and after cardiac transplantation.	X	
73. Skill to manage contraception, preconception evaluation, and pregnancy in cardiac transplant recipients in collaboration with specialists skilled in high-risk pregnancy.		X

AHFTC = advanced heart failure and transplant cardiology.

Table 4. Common Professional Behavior Competencies Relevant to All Clinical Cardiovascular Disease Specialists

SYSTEMS-BASED PRACTICE	All Specialists
1. Incorporate risk-benefit analysis, cost, resource, and value considerations into care of patients with cardiovascular disease.	X
2. Identify and address financial, cultural, and social barriers to adherence with patient care recommendations, including social determinants of health.	X
3. Participate in practice-based continuous quality improvement and safety initiatives.	X
4. Maintain continuity of care with efficient and effective handoffs through transitions of care.	X
5. Refer patients for new therapies, including consideration of participation in clinical trials.	X
6. Participate in hospital-based and regional systems of care for patients with urgent and emergent cardiovascular conditions.	X
7. Collaborate with all cardiovascular care team members to reduce avoidable hospitalizations for cardiovascular disease.	X
8. Collaborate with physicians and healthcare professionals in other disciplines to optimize the care of patients with complex and multisystem disease.	X

PRACTICE-BASED LEARNING AND IMPROVEMENT	All Specialists
1. Identify personal knowledge gaps and seek educational and training opportunities to improve knowledge, skills, and performance.	X
2. Utilize clinical practice guidelines, appropriate use criteria, and other information tools at the point of care to improve clinical decision making.	X
3. Skill to conduct literature searches, abstract and interpret data, and apply results to clinical care.	X
4. Solicit and incorporate feedback from patients, colleagues, and other healthcare team members to improve clinical performance.	X
5. Use hospital and registry data to assess appropriateness, quality, and safety of cardiovascular care.	X
6. Develop the practice of lifelong learning, including regular review of journals and practice guidelines/appropriate use criteria/consensus statements, and attending scientific and continuing medical education meetings.	X

PROFESSIONALISM	All Specialists
1. Demonstrate respect, consideration, and empathy for patients, families, and all members of the healthcare team.	X
2. Understand the potential role of subconscious biases in clinical decision making and interpersonal relationships.	X
3. Practice within the scope of personal expertise, training, and technical skills.	X
4. Seek and integrate advice from consultants in a timely manner.	X
5. Know current evidence-based clinical practice guidelines, consensus statements, appropriate use criteria, and performance measures relevant to scope of practice.	X
6. Identify, disclose, and manage relationships with industry and other entities to minimize bias and undue influence on clinical decision-making.	X
7. Demonstrate high ethical standards in personal and professional conduct.	X

(*continued*)

Table 4 (*Continued*)

PROFESSIONALISM	All Specialists
8. Take responsibility and follow through on professional commitments and obligations in a timely fashion.	X
9. Identify potential for impaired professional performance in oneself and colleagues and take action to mitigate.	X
10. Attend to one's own health, well-being, and abilities to maximize personal and professional performance.	X
INTERPERSONAL AND COMMUNICATION SKILLS	**All Specialists**
1. Communicate with patients and families in an effective, timely, and culturally competent manner.	X
2. Engage patients in shared decision making based upon balanced presentation of potential risks, benefits, and alternatives, factoring in patients' values and preferences.	X
3. Review medical records, complete documentation, and communicate results of diagnostic findings and management strategies to patients and collaborating healthcare professionals in a timely manner.	X
4. Lead and collaborate in interdisciplinary and cardiovascular care teams, treating all team members with respect.	X
5. Compassionately discuss sensitive/difficult topics, including end-of-life care and care of critically ill patients.	X
6. Provide emotional support to patients and families.	X

including the specific competencies required to achieve competence as well as recommendations for minimum procedural volume to demonstrate competence in AHFTC.[4] As practitioners continue in their careers beyond initial training, it is recognized that many practice opportunities and challenges will exist. As such, prescribing specific numerical requirements to any particular procedure is problematic, with patterns of practice varying between individuals as well as during the lifelong practice of AHFTC. However, the AHFTC specialist should be familiar with the literature that has associated improved outcomes with adequate procedural volume. Where appropriate, such data could be used to guide local maintenance of expertise in procedural skills.

In addition, there are a number of ways in which AHFTC specialists can maintain competency and expand lifelong learning in the course of practice and assess their own professional needs for education and performance improvement. Objective competence evaluation in the practice setting can be challenging but can be achieved through the use of assessment tools and learning resources that are available for this purpose and applicable to all AHFTC specialists. Activities that can demonstrate competency include:

- Successful completion of a dedicated AHFTC training program.
- ABIM certification following completion of AHFTC training.
- Certification via a maintenance of certification process.
- Participation in ongoing continuing medical education programs.
- Participation in quality of care measures in hospital databases and national registries (e.g., ACC National Cardiovascular Data Registry), including procedure-specific registries where they apply.
- Performance of an adequate annual volume of endomyocardial biopsy and right heart catheterization to maintain skills that demonstrate proficiency as an AHFTC specialist, and where possible, submission of results for open scrutiny in the appropriate national databases.
- Obtaining adequate training through coursework, proctoring, and simulation laboratories for new or revamped technologies and procedures.

Importantly, there is a growing subspecialization career focus within AHFTC. Specifically, some practitioners limit the scope of their clinical activity to treating patients with advanced heart failure, including those who undergo implantation of a durable ventricular assist device or cardiac transplantation, while others focus on disease management of patients with less advanced heart failure. Thus, although maintenance of some AHFTC competencies is an expectation for all clinical AHFTC specialists, the maintenance of selected AHFTC competencies and the evaluation tools to assess them can be career focused.

Presidents and Staff

American College of Cardiology
Richard J. Kovacs, MD, FACC, President
Timothy W. Attebery, DSc, MBA, FACHE,
Chief Executive Officer
Dawn R. Phoubandith, MSW, Team Leader, Competencies and Educational Gaps
Teresa V. Callahan, Document Production Specialist
Amelia Scholtz, PhD, Publications Manager, Science, Education, Quality, and Publishing
Heart Failure Society of America
Randall C. Starling, MD, MPH, FHFSA, President
John D. Barnes, Chief Executive Officer
Anna Leong, Manager, Publications
The International Society for Heart & Lung Transplantation
Jeffrey Teuteberg, MD, President
Amanda Rowe, Executive Director

Table A1. AUTHOR RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—2020 ACC/HFSA/ISHLT LIFELONG LEARNING STATEMENT FOR ADVANCED HEART FAILURE AND TRANSPLANT CARDIOLOGY SPECIALISTS

Committee Member	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Salary	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Clyde W. Yancy (*Chair*)	Northwestern University Feinberg School of Medicine—Vice-Dean, Diversity & Inclusion; Magerstadt Professor of Medicine; Chief of Cardiology	None	None	None	None	• Abbott (spousal employment)*	None	None
Mark H. Drazner (*Vice Chair*)	University of Texas Southwestern Medical Center—Professor, Internal Medicine; Clinical Chief of Cardiology	None	None	• Trevena†	None	None	None	None
Samuel Tristram Coffin	Maine Health Cardiology—Advanced Heart Failure, Mechanical Circulatory Support, and Transplant Cardiology Attending	None	None	None	None	None	None	None
William Cornwell III	University of Colorado Anschutz Medical Campus—Cardiologist, Advanced Heart Failure, LVAD and Cardiac Transplant	None	None	None	None	None	None	None
Shashank Desai	Inova Heart and Vascular Institute—Medical Director, Heart Failure/Transplant Program	• Abbott • Abiomed • Medtronic	None	None	None	None	None	None
John P. Erwin III	BSW Health—Senior Staff Cardiologist; Texas A&M College of Medicine—Clinical Professor of Medicine	None	None	None	None	None	None	None
Mahazarin Ginwalla	University Hospitals Cleveland Medical Center—Medical Director of Heart Failure; Associate Professor of Medicine	• Xact Laboratories	• ZOLL Medical	None	None	None	None	None
Karol S. Harshaw-Ellis	Duke University Advanced Heart Failure Program—Nurse Practitioner Director of Outreach for Same Day Access Clinic; Duke School of Nursing—Consulting Associate	None	None	None	None	None	Novartis	None

(*continued on next page*)

Table A1 (*Continued*)

Committee Member	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Salary	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Tamara Horwich	UCLA—Associate Clinical Professor of Medicine/ Cardiology	None	None	None	• Samsung[‡]	None	None	None
Michelle Kittleson	Cedars-Sinai Smidt Heart Institute—Director, Heart Failure Research; Director, Post-Graduate Education in Heart Failure and Transplantation; Associate Professor of Medicine	None	None	None	None	None	None	None
Anuradha Lala	Mount Sinai Hospital—Assistant Professor of Medicine, Cardiology	None	None	None	None	None	None	None
Sabra C. Lewsey	Johns Hopkins University School of Medicine—Heart Failure Fellow-in-Training	None	None	None	None	None	• Medtronic	None
Joseph E. Marine	Johns Hopkins University School of Medicine—Vice-Director, Division of Cardiology; Associate Professor of Medicine	None	None	None	None	None	None	None
Cindy Martin	University of Minnesota—Associate Professor of Medicine	None	None	None	None	None	None	None
Karen Meehan	University of Chicago Medical Center—VAD Coordinator[§]	None	None	None	None	None	None	None
David A. Morrow	Harvard Medical School—Director, Samuel A. Levine Cardiac Intensive Care Unit; Professor of Medicine	• Abbott • Aralez Pharmaceuticals[†] • Bayer[†] • GlaxoSmithKline[†] • Merck[†] • Novartis • Pfizer[†] • Roche[†]	None	None	• Abbott[†] • Amgen[†] • AstraZeneca[†] • B•R•A•H•M•S[†] • GlaxoSmithKline[†] • Johnson & Johnson[†] • Novartis[†] • Pfizer[†] • Roche[†] • Singulex[†] • Takeda[†]	None	None	None
Kelly Schlendorf	Vanderbilt Heart and Vascular Institute—Assistant Professor in Medicine; Medical Director, Heart Transplant Program, Associate Director, Advanced HF/Transplant Training Program	None	None	None	None	None	None	None

(*continued on next page*)

Table A1 (*Continued*)

Committee Member	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Salary	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Jason W. Smith	University of Wisconsin—Associate Professor of Surgery, Division of Cardiothoracic Surgery; Surgical Director Heart Transplant and Mechanical Circulatory Support[‖]	• Medtronic	None	None	• TransMedics[‡]	None	None	None
Gerin R. Stevens	Northwell Health—Director of Cardiomyopathy, Medical Director of Heart Failure & Transplant; Zucker School of Medicine at Hofstra/Northwell—Associate Professor of Cardiology	• Novartis[†]	None	None	None	None	None	None

This table represents relationships of committee members with industry and other entities that were determined to be relevant to this document. These relationships were reviewed and updated in conjunction with all meetings and/or conference calls of the writing committee during the document development process. The table does not necessarily reflect relationships with industry at the time of publication. A person is deemed to have a significant interest in a business if the interest represents ownership of ≥5% of the voting stock or share of the business entity, or ownership of ≥$5,000 of the fair market value of the business entity; or if funds received by the person from the business entity exceed 5% of the person's gross income for the previous year. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted. Please refer to http://www.acc.org/guidelines/about-guidelines-and-clinical-documents/relationships-with-industry-policy for definitions of disclosure categories or additional information about the ACC Disclosure Policy for Writing Committees.

According to the ACC, a person has a relevant relationship if: a) the relationship or interest relates to the same or similar subject matter, intellectual property or asset, topic, or issue addressed in the document; b) the company/entity (with whom the relationship exists) makes a drug, drug class, or device addressed in the document, or makes a competing drug or device addressed in the document; or c) the person or a member of the person's household, has a reasonable potential for financial, professional or other personal gain or loss as a result of the issues/content addressed in the document.

*The ACC requires authors to report relationships with industry and other entities for themselves as well as members of their household. This relationship of a household member arose after the document was sent for peer review and did not influence document development. The writing committee member recused from addressing comments or revisions to which that relationship was potentially pertinent.

[†]Significant relationship.

[‡]No financial benefit.

[§]Ms. Meehan was employed by Advocate Christ Medical Center as a VAD transplant coordinator during most of this writing effort.

[‖]Dr. Smith was employed by the University of Washington Medical Center as an Assistant Professor of Surgery; Division of Cardiothoracic Surgery, Associate Surgical Director of Cardiac Transplant and Mechanical Circulatory Support during most of this writing effort.

ACC = American College of Cardiology; BSW = Baylor Scott and White; LVAD = left ventricular assist device; UCLA = University of California, Los Angeles; VAD = ventricular assist device.

Table A2. PEER REVIEWER INFORMATION—2020 ACC/HFSA/ISHLT LIFELONG LEARNING STATEMENT FOR ADVANCED HEART FAILURE AND TRANSPLANT CARDIOLOGY SPECIALISTS

Name	Employment	Representation in Peer Review Process
Larry A. Allen	University of Colorado School of Medicine—Professor of Medicine	Official Reviewer, HFSA
Alison L. Bailey	Erlanger Health System—Chief, Academic Cardiology; University of Tennessee College of Medicine Chattanooga—Affiliated Associate Professor of Medicine	Official Reviewer, ACC Board of Governors
Lavanya Bellumkonda	Yale University—Associate Professor of Medicine (Cardiology)	Official Reviewer, ISHLT
Joseph C. Cleveland Jr.	University of Colorado Anschutz Medical Center—Frederick and Carol Grover Endowed Professor of Surgery; Vice-Chair Academic Affairs, Department of Surgery; Surgical Director Cardiac Transplantation	Official Reviewer, ISHLT
Fabienne Dobbels	KU Leuven—Psychologist; Academic Centre for Nursing and Midwifery—Professor	Official Reviewer, ISHLT
James Fang	University of Utah School of Medicine—Professor and Chief, Division of Cardiovascular Medicine	Official Reviewer, HFSA
Laxmi S. Mehta	The Ohio State University—Professor of Medicine, Section of Preventative Cardiology and Women's Cardiovascular Health	Official Reviewer, ACC Lifelong Learning Oversight Committee
Michael A. Solomon	National Institutes of Health Clinical Center—Senior Research Physician	Official Reviewer, Competency Management Committee (Lead Reviewer)
James E. Udelson	Tufts University School of Medicine—Chief, Division of Cardiology; Director, Nuclear Cardiology Laboratory; Professor of Medicine	Official Reviewer, HFSA
Amrut Ambardekar	University of Colorado—Medical Director Cardiac Transplantation; Associate Professor of Medicine-Cardiology	Content Reviewer, ACC HF&T Section Leadership Council
Laura Blue	Duke University Hospital, Cardiac Transplant Clinic—Nurse Coordinator	Content Reviewer, VAD Transplant Coordinator
Devyani Chowdhury	Cardiology Care for Children—Director	Content Reviewer, ACC Adult Congenital and Pediatric Cardiology Section Leadership Council
Ira M. Dauber	South Denver Cardiology Heart Center—Chief of Heart Failure; Centura Health Colorado—Director, Heart Failure; University of Colorado—Associate Clinical Professor of Medicine	Content Reviewer, ACC/AHA/HFSA/ISHLT/ACP AHFTC Advanced Training Statement
Michael S. Firstenberg	The Medical Center of Aurora and Rose Hospital—Chief, Department Cardiothoracic and Vascular Surgery	Content Reviewer, ACC Surgeons Section Leadership Council
Katie Greenlee	Cleveland Clinic—Cardiology Clinical Specialist (Pharmacist)	Content Reviewer, Cardiovascular Team Section Leadership Council
Tanush Gupta	Montefiore Medical Center, Albert Einstein College of Medicine—Fellow-in-Training	Content Reviewer, Fellows-in-Training Section Leadership Council
Katherine Hoercher	Cleveland Clinic—Director, Kaufman Center for Heart Failure	Content Reviewer, ACC Lifelong Learning Oversight Committee
Stephen P. Hoole	Royal Papworth Hospital NHS Foundation Trust, Cambridge, England, UK—Consultant Interventional Cardiologist	Content Reviewer, ACC Early Career Section Leadership Council
Scott L. Hummel	University of Michigan—Associate Professor; Ann Arbor Veterans Affairs Health System—Section Chief, Cardiology	Content Reviewer, ACC Geriatric Section Leadership Council
Jason N. Katz	University of North Carolina School of Medicine—Associate Professor of Medicine and Surgery	Content Reviewer, ACC/AHA/HFSA/ISHLT/ACP AHFTC Advanced Training Statement
Valentina Kutyifa	University of Rochester Medical Center, Cardiology Division, Clinical Cardiovascular Research Center—Associate Professor of Medicine	Content Reviewer, ACC Electrophysiology Section Leadership Council
Grace Lin	Mayo Clinic—Director, Heart Failure Services, Associate Professor of Medicine	Content Reviewer, ACC HF&T Section Leadership Council
Negareh Mousavi	McGill University Health Center—Assistant Professor of Medicine	Content Reviewer, ACC Cardio-Oncology Section Leadership Council
Gurusher Panjrath	George Washington University—Chair, Heart Failure and Transplant Section	Content Reviewer, ACC HF&T Section Leadership Council
Hena Patel	Rush University Medical Center—Fellow-in-Training	Content Reviewer, Fellows-in-Training Section Leadership Council
Jignesh Patel	Cedars-Sinai Heart Institute—Medical Director, Heart Transplant Program	Content Reviewer, ACC HF&T Section Leadership Council
Erin Perlmutter	Advanced Heart Failure Center—Lead MCS Coordinator	Content Reviewer, ACC Cardiovascular Team Section Leadership Council
Lisa J. Rose-Jones	University of North Carolina—Assistant Professor of Medicine, Division of Cardiology Advanced Heart Failure/Cardiac Transplantation & Pulmonary Hypertension, Program Director, Cardiovascular Disease Fellowship	Content Reviewer, ACC Cardiovascular Training Section Leadership Council

(*continued*)

Table A2 (*Continued*)

Name	Employment	Representation in Peer Review Process
Keith M. Swetz	University of Alabama at Birmingham Medicine Supportive Care and Survivorship Clinic—Medical Director; University of Alabama School of Medicine—Associate Professor of Medicine; University of Alabama at Birmingham and Birmingham VA Medical Center—Attending Physician	Content Reviewer, Palliative Care Expertise
Ryan J. Tedford	Medical University of South Carolina—Chief, Heart Failure; Medical Director, Cardiac Transplantation; Associate Professor of Medicine	Content Reviewer, Pulmonary Hypertension Expertise

This table represents the individuals, organizations, and groups that peer reviewed this document. A comprehensive list of healthcare-related disclosures for each reviewer can be found at http://jaccjacc.acc.org/Clinical_Document/AHFTC_LLS_PEER_REVIEWER_Comprehensive_Disclosure_Table.pdf.

ACC = American College of Cardiology; ACP = American College of Physicians; AHA = American Heart Association; HFSA = Heart Failure Society of America; HF&T = Heart Failure and Transplant; ISHLT = International Society for Heart & Lung Transplantation; MCS = mechanical circulatory support; NHS = National Health Service; VA = Veteran's Affairs; VAD = ventricular assist device.

Appendix 3. Abbreviations

ABIM = American Board of Internal Medicine
ACC = American College of Cardiology
ACGME = Accreditation Council for Graduate Medical Education
AHFTC = Advanced Heart Failure and Transplant Cardiology
COCATS = Core Cardiovascular Training Statement
HFSA = Heart Failure Society of America
ISHLT = International Society for Heart & Lung Transplantation
RWI = relationships with industry

References

1. Alpert JS. Guidelines for training in adult cardiovascular medicine core cardiology training symposium (COCATS) June 27–28, 1994. J Am Coll Cardiol 1995;25:1–2.
2. Williams ES, Halperin JL, Arrighi JA, et al. 2016 ACC lifelong learning competencies for general cardiologists: a report of the ACC Competency Management Committee. J Am Coll Cardiol 2016;67:2656–95.
3. Halperin JL, Williams ES, Fuster V, et al. ACC 2015 core cardiovascular training statement (COCATS 4) (revision of COCATS 3). J Am Coll Cardiol 2015;65:1721–3.
4. Jessup M, Drazner MH, Book W, et al. 2017 ACC/AHA/HFSA/ISHLT/ACP advanced training statement on advanced heart failure and transplant cardiology (revision of the ACCF/AHA/ACP/HFSA/ISHLT 2010 Clinical Competence Statement on Management of Patients With Advanced Heart Failure And Cardiac Transplant). J Am Coll Cardiol 2017;69:2977–3001.
5. Halperin JL, Williams ES, Fuster V. COCATS 4 introduction. J Am Coll Cardiol 2015;65:1724–33.
6. Kavic MS. Competency and the six core competencies. JSLS 2002;6:95–7.