

# Cardiovascular Critical Care Training: A Collaboration between Intensivists and Cardiologists

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## ABSTRACT

With growing patient complexity, the cardiovascular intensive care unit (CICU) of today has evolved substantially from the coronary care unit (CCU) of decades ago. The growing burden of noncardiac critical illness and highly specialized acute cardiovascular disease requires a degree of expertise beyond that afforded through a general cardiology training program. Therefore, the American Heart Association (AHA) has proposed a CICU staffing model to include dedicated cardiac intensivists; in the present day, “dual-trained” physicians are extremely sparse. Guidance on designing critical care fellowships for cardiologists is limited but will require collaboration between cardiologists and medical intensivists. Here, we review the evolution of the CICU, describe training pathways, and offer guidance on creating a cardiology critical care training program.

### Keywords:

critical care cardiology; fellowship training; critical care medicine

In 1961, Desmond Julian, a British cardiologist, presented five cases of cardiopulmonary arrest after myocardial ischemia; one patient survived resuscitative efforts (1, 2). He postulated that most patients could be treated

successfully if rhythm monitors were linked to alarms and if medical, nursing, and ancillary staff were properly trained in closed-chest cardiac massage (1). After his publication in the *Lancet* and near simultaneous publication by American

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cardiologist Morris Wilburne in *Circulation*, the concept of the coronary care unit (CCU) was born (2, 3). Whereas medical intensive care units (ICUs), conceived a decade prior, were places to care for acutely ill patients, CCUs were developed to monitor those at risk for ventricular arrhythmias and arrest (2, 3).

With growing patient complexity, a rise in diverse acute noncardiac illnesses, and the prevalence of more advanced cardiovascular diseases, CCUs have morphed into cardiovascular ICUs (CICUs), blurring their distinction from medical ICUs (3–6). Commensurate with these changes, in 2007 Katz and colleagues called attention to the critical care crisis within cardiology; the tradition of general cardiologists' managing CICUs was believed to be an unsustainable model (4). The model of a closed ICU staffed by intensivists is believed to be most appropriate for tertiary care center CICUs (3, 7). In 2012, the American Heart Association (AHA) published a scientific statement detailing the new need for CICU staffing and describing avenues for fellowship training (3). Although cardiologists with formal intensive care training are still relatively uncommon, interest is flourishing (3, 8–11). Addressing these needs requires a joint venture between cardiology and critical care to design optimal fellowship pathways. Physicians certified in both cardiology and critical care medicine (CCM) should have the professional latitude to function in multiple ICU settings while keenly attuned to CICU specifics such as mechanical circulatory support (MCS) and post-cardiac arrest care. Here, we discuss the modern CICU, with a focus on training the next generation of critical care cardiologists.

## THE MODERN CICU

With the decline in acute coronary syndrome as a primary diagnosis leading to CICU admission over the years, the face of critical care cardiology has seen a significant transformation (12). The CICU of today is a complex multidisciplinary environment with a higher acuity of illness and uses a myriad of advanced monitoring and therapeutic technologies (3, 4). Although ST-segment elevation myocardial infarction accounted for up to 50% of CICU admissions a few decades ago, this diagnosis represents only about 10% of present-day cases (10, 12). Cardiac conditions have increased in their acuity; shock and cardiopulmonary arrest are now among the most common primary diagnoses necessitating CICU admission (12).

In an analysis of 3.4 million CICU admission from 2003 to 2013 among Medicare beneficiaries, the prevalence of noncardiac diagnoses rose from 38% to approximately 52%, with a significant increase in infectious, respiratory, and renal disease (13). Cardiac comorbidities have shifted, with a greater prevalence of heart failure, pulmonary vascular disease, and valvular heart disease (13). In a study including more than 1,000 patients admitted to a tertiary care academic center CICU, 50% of the admissions included either acute respiratory failure, renal failure, or sepsis (6). Moreover, noncardiovascular conditions were the strongest predictors of increased ICU length of stay and most associated with mortality risk (6).

Data from a recently established multicenter network of tertiary care CICUs, the Critical Care Cardiology Trials Network (CCCTN), identified respiratory insufficiency and shock as the leading indications for ICU-level care (5).

This population was frequently treated with advanced therapies: approximately 27% of CICU patients required positive pressure ventilation, 31% of those in shock were treated with MCS, and 36% of the total cohort required vasoactive infusions (5). Substantiating the data from the CCCTN, a large cohort study of patients admitted to a tertiary care CICU identified more than a doubling in the rate of respiratory failure over a decade, with more than 50% of patients requiring invasive mechanical ventilation (14).

Critical illness in the background of complex decompensated cardiovascular disease requires a keen understanding of and attention to both. Evolving CICU complexity and the rise of primary noncardiac diagnoses among admitted patients demand advanced training beyond that of a general cardiologist (4, 15). One must be apprised of the contemporary sepsis management guidelines, facile with the treatment of respiratory failure, adroit with invasive mechanical ventilation, and knowledgeable of the complexities of multisystem organ failure among many other life-threatening diagnoses (16).

### CICU PHYSICIAN STAFFING

Mirroring data from general medical and surgical ICUs, the presence of a dedicated cardiac intensivist is associated with a significant reduction in CICU mortality (7, 17). This finding holds true even when isolating patients with cardiogenic shock, a keystone CICU diagnosis (18). However, only a few CICU directors believe such a model is feasible, because of workforce limitations (19). A large national survey, predominantly involving academic medical centers, revealed care for critically ill cardiac patients is usually provided in a CICU rather than a general medical ICU,

with a near-even split between open- and closed-unit models (19). However, the majority of CICU directors are cardiologists spending <50% of their inpatient clinical time in an ICU setting (19). At the centers reviewed, less than one-third of the time was an intensivist available for consultation on mechanically ventilated patients, a collaborative model known to improve CICU mortality (19, 20). A large gap in care and an unmet need emerges from these data.

In a 2012 scientific statement from the AHA, Morrow and colleagues suggested that an optimal leadership and staffing model for a level 1 CICU, a hub capable of the highest intensity patient care and management of all cardiovascular conditions and most noncardiovascular comorbidities, includes dual-boarded cardiologists (3). This position is echoed by the Canadian National Working Group (21). Such a paradigm is most conforming to the present-day CICUs at tertiary care centers and allows comprehensive care of the most complex patients (3).

However, in a 2012 survey of CICU directors, only 4% of respondents reported being dual boarded in cardiology and CCM (19). In a subsequent study in 2015 and 2016 with heavy representation from community hospitals, dual-boarded physicians in cardiology and CCM were practicing in only 14.7% of CICUs nationally, with somewhat higher percentages at academic medical centers (17). Thus our present-day workforce is far from meeting consensus guideline-based standards in CICU organization.

Understanding these limitations, we are advised of multiple alternative staffing models notwithstanding the optimal clinical outcomes associated with a closed unit and mandatory intensivist involvement (3). One proposed model for

CICU staffing involves an intensivist-run ICU with cardiology consultation.

Although this approach takes advantage of the existing critical care cadre, it should be noted that the current ICU workforce is constrained, with approximately 50% of ICUs in the country lacking a dedicated intensivist (3, 22). As such, there may be value to expanding the number of individuals with competency to care for CICU patients akin to the model applied to neurologic ICUs.

Patients admitted to CICUs are increasingly complex, with highly specialized diagnoses that may benefit from physicians with the corresponding training. Examples of such conditions include advanced heart failure (transplantation, durable and temporary MCS) as well as complex congenital, structural, ischemic, and arrhythmic disorders. The interplay of these conditions with those encountered in medical ICUs (such as sepsis, respiratory failure, and multiorgan failure) creates a unique arena for specialized care. Intensivists may lack expertise in the conditions and the diagnostic and therapeutic modalities specific to this population, more often encountered during cardiology training. General cardiologists consulting on such patients may lack the requisite expertise to properly assist with care. Furthermore, real-time availability to manage deteriorating conditions may not always be possible in a consultative capacity. Although various models have been proposed, experts suggest that a dual-trained physician may be most appropriate for tertiary care centers managing the most complex patients (3).

Alternatively, CICU patients can be integrated into a mixed multidisciplinary unit, allowing greater flexibility and a

spectrum of ICU leadership. These alternative designs may be ideal for secondary referral centers or community CICUs. However, the dual-boarded cardiologist model has the advantage of providing seamless care and leadership under one physician and may best match the needs of a level 1 CICU (3). The European Society of Cardiology has put forth recommendations that CICUs be directed by cardiologists with advanced training in acute cardiovascular care to best manage critically ill patients (23, 24). In a 2020 scientific statement from the AHA, the authors suggested that tertiary care center CICUs transition to cardiac intensivist staffing through new hires and succession planning (25).

## TRAINING CRITICAL CARE CARDIOLOGISTS

### Current Status of Training

American Board of Internal Medicine data through 2014 identified 563 physicians with dual certification in cardiology and CCM (11). Fewer than one-third of these individuals completed CCM fellowship, whereas the majority certified through a practice pathway (11). In a comprehensive national physician database of 473 dual-boarded physicians reviewed before 2015, 80% were initially certified in CCM before 2000, and only one-fifth were actively practicing CCM (26). As the majority were older than 60 years and therefore approaching the average age of physician retirement, it is imperative to expand training programs to meet current and future CICU demands (11). Dual-boarded physicians indicate that ventilator management, treatment of multiorgan system failure, end-of-life care, and airway management are the most essential skills in the care of CICU patients (11). These skills may not be

adequately emphasized in general cardiology fellowships. Furthermore, most dual-certified cardiologists believe that additional CCM training is necessary to effectively practice in the CICU (11). The ability to care for critically ill patients with complex cardiovascular conditions requires proficiencies spanning both disciplines.

Representing the American College of Cardiology, the Core Cardiology Training Statement (COCATS) 4, published in 2015, delineated three levels of training in critical care cardiology (27). While level 1 training is the basic requirement of a 3-year cardiology fellowship, necessitating a minimum of 8 weeks of cardiology critical care exposure, level 3 training requires the completion of an additional 1-year fellowship in CCM (27). Emergent intra-aortic balloon pump placement, endotracheal intubation, CICU team leadership, and the design of quality and safety initiatives were the only four cited core competencies distinguishing the levels of training (27). However, recommendations from a multisociety task force identified 327 specific competencies within CCM largely not included in COCATS 4 (27, 28). Presently, COCATS does not offer specific recommendations for cardiac critical care training. We believe dual-certified physicians should have the prowess to function in most ICU settings with broad cognitive and procedural expertise.

### Fellowship Training Pathways

The growing subspecialty of critical care cardiology has a number of training pathways leading to board eligibility and dual certification (3, 8, 9, 15, 29, 30):

1. A 1-year CCM fellowship offered to those who have completed cardiology training. This pathway requires 12 clinical CCM months over the span of 1 year sequential to a minimum of 24 months of clinical cardiology completed in a 3-year time frame. This is the most common route, allowing the trainee to enter CCM with advanced knowledge of cardiovascular physiology, hemodynamics, and certain procedural skills. Fellows can focus rotations on those most useful for a CICU career (e.g., additional time spent in the cardiovascular surgery ICU) while maintaining exposure to a broad array of ICUs.
2. A 4-year integrated cardiology and critical care training program. Such may be offered at some institutions, with most CCM volume taking place in the final year of training. This pathway would resemble that of a combined 3-year pulmonary medicine and CCM training program. This avenue has the advantage of allowing up to 6 months of CICU time obtained over the course of a cardiology fellowship to count toward CCM training, decreasing clinical months and allowing more focus on scholarly activity. Over 4 years, the trainee completes a minimum of 30 clinical months, including 12 months of critical care clinical training, for dual certification.
3. A 2-year CCM fellowship preceding cardiology fellowship training. This model allows the CCM-trained individual to enter a cardiology fellowship with advanced cognitive and procedural skill set in critical care. However, this has the disadvantage of increasing total training time to 5 years. Furthermore, maintaining CCM skills over the subsequent 3-year cardiology fellowship may pose additional challenges.

Although interest is growing, a small subset of cardiologists elect to complete training in both critical care and an additional subspecialty such as interventional cardiology or advanced heart failure. The critical care–interventional cardiologist may be uniquely qualified to manage coronary emergencies, vascular access complications, and percutaneous MCS devices. Beyond proficiency in cardiogenic shock, the critical care–heart failure physician will offer additional expertise in cases of

urable ventricular assist devices and cardiac transplantation. Furthermore, these individuals may offer longitudinal care for their patients. Despite such appeal, training is prolonged, and maintaining procedural and cognitive skills in multiple domains may prove challenging. When incorporating research or administrative efforts, one may find that only a few months will be dedicated to each domain per year (31). However, hybrid training provides for diverse expertise and the added perspective of a physician bridging multiple spheres of medicine.

### Sample Curriculum

Table 1 describes the rotations constituting the CCM year at New York University Grossman School of Medicine offered to cardiology fellowship graduates, highlighting select clinical and procedural competencies. In a recent report, O'Brien and colleagues proposed that CCM training for cardiologists should prioritize airway and ventilator management, mixed shock, MCS, renal replacement therapies, neurologic emergencies, and postoperative cardiac surgery care (15). Their recommendations are based on CCCTN data descriptive of the case mix in CICUs nationally. Presently, there is minimal guidance available in the literature surrounding CCM fellowship design for cardiologists, as few such programs exist. We therefore present our curriculum, with rationales behind individual rotations, as a guide for programs aiming to establish similar training pathways.

We believe that a graduate of a program in cardiology CCM should obtain robust training to manage a wide spectrum of critical illnesses encountered in medical, surgical, neurologic, and cardiac ICUs to truly be an expert intensivist upon graduation. With variability in exposure

to certain aspects of advanced cardiology during general fellowship training, the CCM year may serve as an opportunity to address insufficiencies. For instance, transesophageal echocardiography may be focused on identifying pathology common to cardiac surgery, and ultrasound may be expanded to other organ systems. A more in-depth grasp of the management of MCS may be developed through rotations in the cardiothoracic surgery ICU or alternatively during an advanced heart failure elective. Airway management proficiencies may be customized to patients with cardiogenic shock or right ventricular failure to build on general training.

Importantly, time spent in a clinical setting is insufficient to ensure the acquisition of skills required for cardiology CCM practice. Competency-based curricula are essential for training programs (32–34). In 2009, a multisociety task force established 327 specific competencies for internal medicine–based critical care (28, 34). Subsequently, curricular milestones and entrustable professional activities were delineated within pulmonary medicine and CCM as a means to measure the effectiveness of medical training on the basis of educational outcomes (34). Much of that established within CCM can be applied to cardiology CCM training. Future collaboration between professional societies within cardiology and CCM to define specific competencies for the cardiac CCM trainee would be welcome as programs grow in number. On an institutional level, the principle of competency-based medical training allows flexibility to tailor the CCM year to the individual. The program director and clinical competency committee are responsible for ensuring the achievement of milestones, confirming competence, identifying



**Table 1.** Proposed rotations for a 1-year cardiac critical care fellowship

Rotation	Total Blocks	Selected Clinical Exposures and Competencies	Selected Procedural Competencies
MICU	5	Respiratory failure and ventilator management, airway management, VV-ECMO, multiorgan failure, renal replacement therapies, septic shock, team leadership, quality improvement initiatives, palliative care	Endotracheal intubation, central line and arterial line insertion, bedside bronchoscopy, thoracentesis, chest tube placement, lumbar puncture, paracentesis, point-of-care ultrasound
SICU	1.5	Trauma, hemorrhagic shock, VV-ECMO, solid organ transplantation, abdominal emergencies, management of postoperative complications	Endotracheal intubation, central line and arterial line insertion, bedside bronchoscopy, thoracentesis, chest tube placement and management, paracentesis
CVICU	1	VA-ECMO, percutaneous MCS, durable LVAD, surgical complications, postcardiotomy shock	Cardioversion and defibrillation, pulmonary artery catheterization, IABP placement, chest tube insertion, transesophageal echocardiography
Neurologic ICU	1	Traumatic brain injury, ICP monitors, stroke, intracranial hemorrhage, neuromuscular disease, brain death assessment	Lumbar puncture, ICP monitoring via invasive devices and noninvasive ocular nerve sheath diameter ultrasound
CICU	1	Function as a junior CICU attending, MCS, durable LVAD, cardiogenic shock, complex arrhythmias, therapeutic hypothermia	Cardioversion and defibrillation, TVP insertion, pulmonary artery catheterization, IABP placement, pericardiocentesis, transesophageal echocardiography
Interventional pulmonology	0.5	Bronchoscopy, tracheostomy management, approach to massive hemoptysis	Bronchoscopy
Pulmonary hypertension	0.5	Pulmonary artery catheterization, management of right ventricular physiology and failure	Pulmonary artery catheterization
Pulmonary physiology laboratory	0.5	Advanced understanding of respiratory physiology, cardiopulmonary exercise testing, pulmonary function testing	

**Table 1. Continued.**

Rotation	Total Blocks	Selected Clinical Exposures and Competencies	Selected Procedural Competencies
Cardiac anesthesia	0.5	Advanced airway management, cardiopulmonary bypass physiology, advanced cardiovascular physiology	Endotracheal intubation, pulmonary artery catheterization
Toxicology	0.5	Management of toxic exposures common to the ICU (acetaminophen, salicylates, AV nodal blocker overdose), understanding of toxidromes and common antidotes	

*Definition of abbreviations:* AV = atrioventricular; CICU = cardiovascular intensive care unit; CVICU = cardiovascular surgery intensive care unit; IABP = intraaortic balloon pump; ICP = intracranial pressure; ICU = intensive care unit; LVAD = left ventricular assist device; MCS = mechanical circulatory support; MICU = medical intensive care unit; SICU = surgical intensive care unit; TVP = transvenous pacemaker; VA-ECMO = venoarterial extracorporeal membrane oxygenation; VV-ECMO = venovenous extracorporeal membrane oxygenation.

Rotations are listed with total time spent, highlighted clinical skills, and procedural skills emphasized. One block is 4 weeks in duration.

additional areas of focus, and tailoring the year accordingly (35).

## PRACTICAL GUIDANCE

Starting a cardiology CCM fellowship, whether *de novo* or as an expansion from an existing pulmonary and CCM or CCM fellowship program, takes a systematic approach involving attention to funding, infrastructure and accreditation, curriculum design, collaboration, and ultimately recruitment (36).

### Funding

Funding will be needed to pay for the salary of the fellow(s) as well as any operating and administrative program costs. Options for funding include institutional support, either from hospital funding or from separate divisional or departmental funding (cardiology or pulmonary medicine and CCM), or philanthropic funding in the

form of private or public educational grants. Cardiology divisions seeking to expand the CICU workforce may have an interest in financially supporting such a fellowship, as it could lead to downstream benefits in recruitment and retention.

### Infrastructure and Accreditation

This will require working with your designated institutional official and local graduate medical education office to have institutional sponsorship and initiate the application process with the Accreditation Council for Graduate Medical Education (ACGME). Highlighting the need and the short- and long-term benefits will be important for buy-in. If new sites are contemplated, program letters of agreement with those sites will also need to be created as part of the application process. Thus buy-in requires support from the faculty (both within and without the division),



program and divisional or departmental leadership, the institution for tacit acceptance and potential funding, and governing bodies both locally and nationally (your graduate medical education office and the ACGME, respectively).

### Curriculum Design

Twelve months of clinical rotations minus vacation can be a short amount of time to develop competency in all necessary areas of CCM. As such, a thoughtful approach is important, incorporating stakeholder analysis (the needs of the individual trainees entering your program, the desires of your division[s], and the expectations of your institution), and pairing that with an honest assessment of the institutional resources available to the program. The key is to iteratively change rotations on the basis of individual and programmatic feedback, as the initial curriculum will be far from perfect.

### Collaboration

Although the bulk of rotations can be taken directly from the existing curriculum of the CCM or pulmonary medicine and CCM training program, there are differences in the training needs of cardiology CCM trainees, as we have highlighted. As such, new rotations will likely need to be created, which will take leveraging relationships with different ICU and rotation directors at your institution. The key is to emphasize the potential positive impacts inherent to such collaboration. With these individuals, you will need to create rotational goals and objectives, obtain feedback and conduct assessments, and in partnership improve the rotations iteratively. For proficiencies your institution lacks (e.g., venoarterial extracorporeal membrane oxygenation

[ECMO]), be willing to reach out to regional ECMO center directors to set up visiting rotator electives.

### Recruitment

The first and easiest place to recruit is internally, assuming your institution has a general cardiology fellowship. Work with your cardiology program director and faculty to identify general cardiology fellows interested in pursuing this additional training, and have them explore this interest and meet with program leadership during the course of their general fellowships. For external recruitment, update your training website to highlight this new track, and ask your faculty (intensivists and cardiologists) to inform others about the new program and help solicit applicants. Develop a written description of the new program that you can send to potential candidates, as well as to cardiology program directors in the regional area. Critical care positions should be formally offered through the National Resident Matching Program subspecialties match.

### Future Directions

Cardiologists seeking dual certification may complete a year of CCM fellowship, but an ACGME-accredited cardiac critical care fellowship does not presently exist. Curricular specifics may vary by institution, provided they follow ACGME requirements, and therefore experience may vary among programs. One potential future pathway may include a 4-year combined cardiology and critical care program. In this scenario, cardiology fellows with an early interest in the field may tailor their curricula toward cardiology CCM throughout the entirety of their training. Cardiology electives may be geared to enhance exposure to MCS and

the cardiovascular surgery ICU. At the completion of the program, the fellow would then be eligible for both cardiology and CCM boards through the American Board of Internal Medicine.

### PERSPECTIVE OF A RECENT TRAINEE

The COVID-19 pandemic found me (E.Y.), a general cardiologist, deployed as a medical ICU attending physician. Although I had some acquaintance with CCM through my work in the CICU, the gaps in knowledge and procedural acumen became apparent. Therefore, after 5 years as an attending physician at a tertiary care academic medical center with service responsibilities spanning consultation, the telemetry ward, and the CICU, I took a sabbatical for a year of CCM training. Through the support of the institution and a joint vision between cardiology and the pulmonary medicine and CCM divisions, a curriculum best suited for my needs was established (Table 1). The fellowship was ACGME approved and funded by an educational grant. ACGME approval was necessary to allow future board certification and afford the ability to practice in a variety of ICU settings. As the discipline grows, CCM board certification may be a requirement at some centers to practice in the CICU setting; anticipating this, we believed that ACGME approval was important.

Entering with cardiology training and experience, I was better able to identify personal goals and add precision to my clinical focus. I recognized that at this time, I was not a specialist in cardiovascular diseases but a trainee in CCM. The opportunity to learn from experts while working in the “trenches” was welcome. This degree of mentorship

and guidance may not be possible on an attending physician level, and the challenge of mastering a new skill set with constant feedback was refreshing. By the end, I had a solid foundation in the care of a diverse population of critically ill patients and considered myself skilled in airway and ventilator management, as well as in critical care procedures. The additional spotlight on ECMO and other forms of MCS placed me in the ideal position to manage the most complex patients in the CICU and cardiovascular surgery ICU. Although confident in my ability to attend in the CICU before fellowship, the CCM year was insightful in the realization that true expertise in this field necessitates the additional training.

On a larger scale, this experience strengthened the partnership between cardiology and the pulmonary medicine and CCM divisions. New joint conferences, symposia, and research endeavors have directly resulted from this collaboration. Pulmonary medicine and CCM trainees now partake in a CICU elective and enjoy additional cardiac-focused conferences added to their curricula provided by CICU faculty. The cardiology division welcomes intensivists to previously cardiology-centered conferences and benefits greatly from their perspective. A recent graduate of our cardiology fellowship is now enrolled in the CCM program, with much interest in a similar track from more junior cardiology fellows, including those at other institutions. Also, having gained multiple new friends and colleagues is invaluable personally and professionally.

Understandably, it is not very realistic to have cardiologists practicing in a CICU setting take a sabbatical for additional

training. Seasoned cardiologists working in CICUs may have a high degree of skill in the management of noncardiac critical illness afforded by experience. However, cardiology fellows seeking such a career path in the present day recognize that this avenue will likely become compulsory and will alter staffing with time. Therefore, cardiologists without CCM training should partner with their critical care colleagues and develop protocols surrounding scenarios requiring CCM consultation. Examples of these scenarios may include cases of acute respiratory distress syndrome (ARDS) or complex respiratory failure, multiorgan failure, and sepsis. In addition, CICUs staffed by general cardiologists should work to develop quality improvement initiatives and checklists common to other ICUs to ensure that the highest standards of care are met. Simulation-based training may be incorporated into continuing medical education at an institutional level to ensure CICU-based cardiologists are adept

at managing scenarios encountered in the medical and surgical intensive care setting.

## CONCLUSIONS

Cardiac critical care is a field in evolution born out of necessity. Although this phenomenon has been recognized for more than a decade, there is minimal guidance on the structure of a cardiac CCM training program. We offer a truly multidisciplinary approach that affords the trainee exposure to multiple aspects of critical care; the graduate will be equipped with the knowledge base and skill set to work in a variety of ICU settings while maintaining a focus on the CICU. As demand grows, cardiologists and medical intensivists will need to collaborate to design the optimal training programs, ensuring that cardiologists have expertise in medical critical illness as well as in more specialized areas of cardiology (e.g., MCS).

**Author disclosures are available with the text of this article at [www.atsjournals.org](http://www.atsjournals.org).**

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