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Analysis of the variations between Accreditation Council for Graduate Medical Education requirements for critical care training programs and their effects on the current critical care workforce☆,☆☆

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ABSTRACT

Adult critical care medicine (CCM) is ill prepared for the demands of an aging US population. Sources have acknowledged a severe shortage of intensivists, yet there has been minimal discussion on the lack of critical care training opportunities. Inconsistencies in training options have led to fragmentation of how critical care services are provided to the US adult population. Significant differences exist between CCM without pulmonary and pulmonary critical care (PCCM) training as it relates to critical care coverage, patient population, and procedural skill of a trainee. The Internal Medicine Residency Review Committee appears more aligned with the PCCM vision of training rather than the CCM; thus, many PCCM programs are more available than pure CCM. Internal medicine offers the greatest pool of candidates to practice full-time CCM, yet there are minimal opportunities for internists wanting to go into straight CCM without also receiving pulmonary training. However, because many PCCM physicians spend a significant amount of time outside critical care, current PCCM training options do not meet the demand for critical care physicians. In this article, we review the barriers to critical care training opportunities and expanding the intensivist workforce and propose reasonable and practical solutions.

1. Introduction

Adult critical care medicine (CCM) as currently practiced in the United States is ill prepared for the rising demands that will be placed on it in the upcoming years because of an ever-increasing aging population. In 2009, national health expenditures in the United States were estimated to be $2.5 trillion, accounting for 17.6% of the gross domestic product [1]. Although the landscape of US patient care delivery has evolved over the past 20 years, with shifting of previous inpatient care to the outpatient arena, intensive care unit (ICU) use has increased because hospitalized patients are sicker. Recent analysis revealed that even though the total number of hospitals and hospital beds has decreased, the number of ICU beds in the United States increased from 85 000 in 1986 to 94 000 in 2005 [2]. Data from the Bureau of Census estimate that there will be a 30% increase in growth of the population 65 years and older by 2015 and 50% by 2020 [3]. As the adult population ages, the need for critical care services will invariably increase, as well [4]. At present, the US population uses 23.2 million ICU days at an estimated cost of $81.7 billion annually. This figure correlates with 13.4% of hospital costs, 4.1% of the national health expenditure, and 0.66% of the gross domestic product [1]. Increasingly, studies have shown that intensivist-directed units not only improve patient outcomes but also substantially decrease costs [5,6]. It has been suggested that $3.3 million in annual cost savings could be realized for each 12- to 18-bed unit if care were delivered by intensivist-led teams [7]. Despite calls from industry leaders [8], many ICUs still lack the comprehensive multidisciplinary approach to patient care, and less than 40% of all ICU patients are currently treated by an intensivist-led model [3]. In addition, there remains a general lack of public awareness of a full-time intensivist as a dedicated specialist in the care of critically ill patients. This is in strong contrast to that of a single-organ specialist such as a “heart doctor” or “lung doctor.” Multiple sources have acknowledged that there is a severe shortage of “intensivists” in the workforce [9–13]. However, there has been minimal discussion regarding one of the main reasons for this shortage, specifically the lack of general critical care training opportunities.

2. Fragmentation of care

In the early 1970s, the founding members of the Society of Critical Care Medicine (SCCM) sought to create one common pathway toward board certification for the management of critically ill patients for physicians from internal medicine (IM), surgery, or anesthesia [14]. The practice of CCM in many other countries has

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taken up this vision with the care provided by a dedicated specialist or intensivist. This practice is also the norm for most pediatric ICUs in the United States. In Europe, for example, although the advent of the intensivist was initially led mainly by anesthesiologists, their philosophy of CCM recognized the distinct skills of the intensivist who is dedicated to the care of all ICU patients (medical and surgical) exclusively rather than caring for them in conjunction with other patient care responsibilities [15]. Subsequently, other countries such as Spain, Australia, and New Zealand have now made critical care an independent and distinct medical specialty similar to the fields of IM, surgery, or ob-gyn (Table 1). Unfortunately, the inability of the primary specialties to incorporate a single board certification for adult critical care in the United States led to each primary specialty creating its own pathway to certification. This, in turn, may play a role in the prevention of the development and recognition of critical care as a distinct discipline. The inconsistencies in training have led to fragmentation of how critical care services are provided to the US adult population. In many large academic centers, surgical ICUs are managed by either surgical or anesthesia intensivists and the medical ICUs by IM-based intensivists. Medical ICUs are further divided with care from some physicians who practice full-time critical care and those who split between critical care and the practice of pulmonary medicine. Recently, further fragmentation has occurred with the advent of neurocritical care, which does not require formal training in IM, surgery, or anesthesia. In addition, the American Heart Association released a position paper calling for a new cardiology-based critical care fellowship [16]. The increasing fragmentation of critical care may lead to a growing number of physicians focused on the management of single-organ failure but who lack the skills needed in managing patients with multiple-organ dysfunction. The lack of unified critical care training can create gaps and inconsistencies in patient care and may result in poorly coordinated ICU management in many mixed units (combined medical, surgical), which are commonly seen in non–university-based academic centers and the majority of community hospitals, and parallels the difficulties seen in most open ICUs.

3. Current training opportunities

Unlike pediatric critical care, which supports a single pathway for training, there exist several approved pathways through the Accreditation Council for Graduate Medical Education (ACGME) for adult critical care certification. This includes pathways developed through anesthesia, surgery, and IM. In addition, there are 3 pathways for IM physicians to obtain training and certification in critical care: 3-year pulmonary critical care (PCCM), 2-year CCM without pulmonary, and a 1-year CCM track obtained after completion of another ACGME-accredited fellowship. The latter is most commonly used by pulmonary graduates but is occasionally used by physicians completing other fellowships such as cardiology, nephrology, or infectious disease. Over the last 25 years, the numbers of 3-year PCCM programs and fellowship positions have markedly increased, yet the straight 2-year CCM training programs and fellowship numbers have decreased [3]. The increase in PCCM is mostly caused by many pulmonary training programs adding a 1-year CCM training to allow candidates to become certified in both pulmonary and critical care. At first glance, it may appear that the PCCM fellowship programs are meeting the growing needs of critical care services in the United States. However, practice options for PCCM graduates include both inpatient and outpatient pulmonary medicine, interventional pulmonary, and sleep medicine, in addition to critical care. In fact, estimates show that less than 25% of a PCCM physician's practice time is devoted to the care of the critically ill [17]. There are several other non–ACGME-accredited pathways to critical care training, the most common being neurocritical care, which is offered through the United Counsel of Neurologic Subspecialties (UCNS) [18].

Table 1
Countries that provide CCM as a primary specialty

Country
Argentina[a]
Australia[b]
New Zealand[b]
Spain[c]
United Kingdom[d]
Uruguay[a]

[a] Estenssoro E, Valente Barbas CS, Briva A. Picking up the pieces: towards a better future for CCM in three South American countries. *Am J Respir Crit Care Med*. 2013 Jan 15;187(2):130–2.

[b] College of Intensive Care Medicine of Australia and New Zealand. Available at: http://www.cicm.org.au/trainprogram.php. Accessed June 6, 2013.

[c] Evans T, Elliott MW, Ranieri M, Seeger W, Similowski T, Torres A, Roussos C. Pulmonary medicine and (adult) critical care medicine in Europe. *Eur Respir J*. 2002;19:1202–1206.

[d] Faculty of Intensive Care Medicine. Available at: http://www.ficm.ac.uk/training-icm. Accessed June 6, 2013.

4. Differences in training

The concept of critical care training as it relates to critical care coverage, patient population, and procedural skill of the trainee differs between 3-year PCCM and 2-year CCM programs. Many stand-alone CCM programs require fellows to take in-house call because it is felt to be an important component of their training toward becoming a full-time intensivist. In contrast, fellows in many PCCM programs take home call. Although some PCCM programs do have in-house call, frequently this is limited to their surgical ICU or trauma rotations. Given the variability of in-house call, some PCCM program directors may feel that mandating in-house call may negatively impact their recruiting of fellows. In addition, the spectrum of patients seen in the units is different between PCCM and CCM. Many PCCM programs focus on medical ICU rotations with only few months allocated to patients undergoing surgery and neurosurgery and patients with trauma. In many instances, these surgical months are often on a consultant or observational status. In addition, further requirements of the PCCM fellow (pulmonary conferences, clinics, pulmonary call, and post–call absences) may limit their availability during their non–medical ICU rotations. Alternatively, most pure CCM programs focus on a wide spectrum of ICU patients including medical, neurologic, obstetrical, surgical, and all surgical subspecialties such as trauma, vascular, cardiothoracic, and neurosurgery. Critical care medicine programs often have mixed units requiring management by the fellow and attending of medical, surgical, and neurologic ICU patients on any given day. In addition, it is common for many stand-alone CCM programs to include faculty from anesthesia and surgical critical care as core members of the fellowship. Finally, the priority of acquiring procedural skills for PCCM appears different from what is important to the CCM programs. Pulmonary critical care seems to emphasize bronchoscopy over all other procedures because it is the only procedure to have a minimum requirement for graduation [19]. This requirement has subsequently also been placed on CCM fellows. There is no set number for any other frequently performed ICU procedure such as intubation, central line, or chest tube placement, all of which are vitally important in the day-to-day management of critically ill patients. The IM Residency Review Committee (IM-RRC) appears to be more aligned with the PCCM vision of training rather than the CCM programs. They have placed an emphasis on what constitutes “medical” ICU training, mandate that only IM-based physicians can qualify as key clinical faculty (KCF), and list bronchoscopy as the only procedure with a specific number required for graduation from both PCCM and CCM programs [19,20].

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5. Restrictions on CCM training opportunities

Serious inequities exist between adult pathways to critical care training. Accreditation Council for Graduate Medical Education requirements for IM-based CCM training are burdensome to both established fellowships and institutions attempting to create new programs. The IM-based critical care fellowship program is the most restrictive not only among all IM-based fellowships but also when compared with either pediatric or the other adult-based critical care fellowships. Section 1.A.2 of the ACGME critical care requirements mandates that primary training sites must sponsor at least 3 additional accredited fellowship programs from the following: cardiovascular, pulmonary, nephrology, gastroenterology, or infectious diseases [20]. This prevents many well-suited academic institutions from initiating critical care training programs. A recent survey of Designated Institutional Officials and IM residency program directors revealed that the multiple-fellowship requirement is the number 1 barrier in initiating IM-based critical care fellowship programs [21]. No IM fellowship other than CCM or PCCM has such a specific requirement because the ACGME and IM-RRC have removed the "multiple-fellowship requirements" from all other IM fellowships. Interestingly, there is no reciprocal requirement of critical care fellowship necessary to start a cardiology, gastroenterology, infectious disease, or nephrology fellowship. Of the 180 plus cardiology fellowship programs, nearly one third are at institutions that do not have the 3 specific fellowships required for critical care [22]. The authors are unaware of any data or consensus papers that stipulate the need for additional fellowships to train critical care physicians [23–27]. The multiple-fellowship requirement is also biased toward creating PCCM programs because only 2 other fellowships listed would be needed as pulmonary counts toward 1 of the 3 fellowships. This may also help explain the ability of former pulmonary programs to easily transition into PCCM programs, as mentioned previously. However, creating a CCM program without pulmonary requires having 3 of the remaining 4 fellowships. In addition, there is a tighter KCF-to-fellow ratio in CCM programs compared with all other IM fellowships including PCCM. Although all fellowship programs initially start with a ratio of 1 KCF to 1 fellow, all fellowships, including PCCM, eventually have a minimum ratio of 1 KCF for every 1.5 fellows. This is in contrast to CCM that maintains a ratio of 1 KCF for every 1 fellow [28]. This stipulation limits the ability of current CCM programs to increase fellowship size that no other IM subspecialty has to face. For example, a PCCM program must have 6 KCFs to have a fellowship complement of 9 PCCM fellows; however, a CCM program must have 9 KCFs to have a training program with 9 CCM fellows.

Major inconsistencies exist in ACGME critical care fellowship requirements between anesthesia, surgery, and IM programs, as well. Neither anesthesia nor surgical critical care mandates the 3 additional fellowships requirement seen with the IM programs. Fourteen surgical critical care fellowships would no longer exist if they had to adhere to this requirement (Table 2) [29]. Of note, many of the 14 institutions with surgical critical care fellowship training programs listed in Table 2 also have at least 1 IM-based fellowship but, at present, are unable to create a CCM fellowship program because of the restriction discussed above. In essence, the ACGME and the IM-RRC have arbitrarily created an environment in which academic institutions can train medical subspecialists and surgical intensivists, but these same institutions are not eligible to train medical intensivists based solely on the stipulation that they do not have the specific multiple medical fellowships.

Lastly, the IM-RRC restricts board-certified critical care physicians from anesthesia, surgery, or emergency medicine (EM) from being KCF [20]. The IM-RRC has adopted a philosophy that only an IM doctor should get "credit" for training an IM resident or fellow. The ACGME and IM-RRC fail to recognize the significant crossover between the medical and surgical ICU patients that was evident to the SCCM founding members. Most would agree that an anesthesiologist with critical care training would bring an added value to any CCM program, for example, in managing the airway. The pathophysiology, clinical course, and treatment for the critically ill are similar, regardless of whether a patient is medical or surgical. Most textbooks on CCM do not make the distinctions between medical or surgical that have been made by the ACGME. A large percentage of CCM-trained physicians manage both medical and surgical ICU patients, especially in community hospitals where mixed medical-surgical units are common. Increasingly, many hospitals and critical care groups are now looking for intensivists from any critical care discipline to help care for their ICU patients, regardless of primary training.

6. Limited IM CCM training opportunities

Most (77%) of current US critical care physicians have obtained their training in a combined pulmonary and critical care fellowship [17]. As previously mentioned, PCCM physicians currently spend only 23% of their time in the care of critically ill patients [17]. In addition, no good database presently exists with regard to breakdown of critical care time vs other patient responsibilities for surgery- or anesthesia-based critical care physicians. When compared with graduating surgery or anesthesia residents, IM offers the greatest pool of candidates who can train and practice full-time CCM. However, the IM-RRC has created a system with minimal opportunities for internists wanting to go into straight critical care without additional pulmonary training. At present, there are 200 surgical critical care and 155 anesthesia critical care fellowship positions for the 7600 surgical and almost 6000 anesthesia residents, respectively. However, there are only 200 straight CCM fellowship positions for nearly 24 000 IM residents in training. In addition, data from the ACGME Web site list 146 academic institutions sponsoring some form of IM-based critical care fellowship. The overwhelming majority, 112, have a 3-year PCCM fellowship, whereas 26 have both a 3-year PCCM program and a 2-year CCM fellowship. Thus, there are only 8 institutions that have a 2-year CCM fellowship that do not also sponsor a pulmonary program (Fig. 1). Overall, there are 1503 PCCM fellowship positions compared

Table 2
ACGME-accredited surgical critical care programs with less than 3 required subspecialty trainings[a]

Program name	City, state	On-site fellowship[a]
University of Tennessee Medical Center at Knoxville	Knoxville, TN	CV, P
Lehigh Valley Health Network; University of South Florida College of Medicine	Allentown, PA	CV, N
Michigan State University	Lansing, MI	CV, ID
Palmetto Health/University of South Carolina School of Medicine	Columbia, SC	ID, P
Orlando Health	Orlando, FL	ID
Carolinas Medical Center	Charlotte, NC	GI
Eastern Virginia Medical School	Norfolk, VA	ID
University of Hawaii	Honolulu, HI	CV
Grand Rapids Medical Education Partners; Michigan State University	Grand Rapids, MI	None
Lincoln Medical and Mental Health Center	Bronx, NY	None
Maricopa Medical Center	Phoenix, AZ	None
Medical Center of Central Georgia; Mercer University School of Medicine	Macon, GA	None
University of Nevada School of Medicine	Las Vegas, NV	None
University of Tennessee College of Medicine at Chattanooga	Chattanooga, TN	None

CV indicates cardiovascular disease; IG, gastroenterology; ID, infectious diseases; N, nephrology (N); P, pulmonary disease.
Based on a published number of programs on https://www.acgme.org/ads/Public as of November 21, 2012.
[a] Required programs include CV, GI, ID, N, or P.

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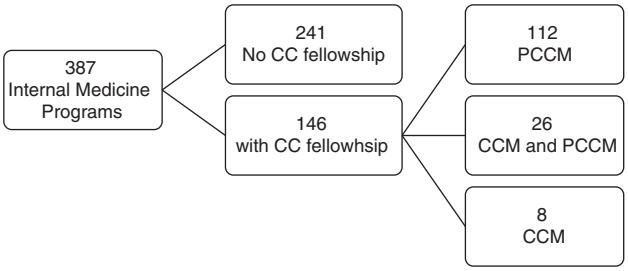

Fig. 1. Distribution of CCM and PCCM fellowship programs. CC indicates critical care. Based on a published number of programs on https://www.acgme.org/ads/Public as of November 21, 2012.

with 200 in CCM [30]. If one were to assume 500 graduating PCCM fellows a year, as per current practice patterns, less than 125 full-time equivalents would be developed for critical care by the PCCM programs annually. The ACGME lists 34 IM-based CCM programs. However, when compared with the larger PCCM programs at their institutions, many of the 2-year CCM programs are small and list only 1 to 2 fellows per year (Tables 3 and 4). Most (104) of CCM fellowship positions are located at 7 institutions. Consequently, there are only 99 CCM positions available throughout the rest of the country. The lack of positions is even more pronounced when one takes into account that, on average, only 100 straight CCM graduates are added to the workforce every year. Overall, this is a woefully low number of IM-based intensivist CCM training programs and fellowship positions. To highlight the ongoing restrictive nature faced by the stand-alone CCM programs; one should be aware that within only a few years of existence, there are now more neurocritical care fellowships (40) sponsored by the UCNS than the 2-year IM CCM training programs sponsored by ACGME [18].

7. Solutions

Several potential solutions are available to address the barriers to critical care training opportunities and expand the intensivist workforce.

First and foremost, more pure CCM programs and fellowships positions need to be created. This can be performed by unifying ACGME requirements across adult critical care disciplines. The growing hospitalist movement shows the increasing popularity of hospital-based careers among IM residency graduates [31,32]. At present, there are only 100 fellowship positions available in straight CCM a year or 1 for every 80 graduating IM residents. The lack of 2-year fellowship positions prevents many potential applicants from applying for critical care training because they may not wish to do an additional third year of fellowship or practice pulmonary medicine. Recently, a position paper published by both the *Society of Hospital Medicine and SCCM* called for a 1-year tract for hospitalists who wished to obtain critical care certification [33,34]. This proposal, however, was met with some skepticism because many thought that it may create a 2-tier system in terms of critical care training and certification [35]. Increasing the number of 2-year CCM positions may provide a better alternative.

Second, standardize the KCF-to-fellow ratio for CCM. This requires 2 changes. First, the IM-RRC needs to adjust the KCF-to-fellow ratio for CCM to be consistent with all other IM fellowships. As mentioned previously, CCM is the only IM-based fellowship that remains at a ratio of 1 KCF to 1 fellow, whereas all other fellowships eventually increase to a ratio of 1 KCF to 1.5 fellows. This allows the larger programs to increase fellowship complement without forcing them to add more faculties. In addition, permit surgical- and anesthesia-based intensivist to be KCF. The ACGME must break down the silos that have placed strict barriers between surgery, anesthesia, and IM when it comes to the care of the critical ill. This would enable current CCM programs to create an opportunity to increase fellowship positions if they so desired.

Third, provide greater opportunities for EM physicians to obtain critical care licensure. Emergency medicine physicians have shown increased interest in additional training in critical care and can now sit for critical care certification through the American Board of Emergency Medicine after completing a 2-year CCM fellowship. Unfortunately, many restrictions have been placed on potential EM candidates, including only allowing 25% of any CCM program's fellowship complement to be occupied by an EM graduate and that all EM graduates must have completed at least 6 months of IM training during their EM residency [20]. Critical care training programs should be allowed to accept the best candidates, and an arbitrary ratio of IM to EM fellows should be eliminated. However, without an increase in the absolute number of fellowship positions, substituting an EM graduate in place of an IM graduate will have no net benefit from dealing with the lack of intensivists in the current workforce.

Fourth, the ACGME must standardize requirements for critical care not only between PCCM and CCM but also for all adult critical care

Table 3
Critical care medicine training programs—PCCM predominant

Program name	City, state	CCM positions approved (filled)	PCCM positions approved (filled)
Cleveland Clinic Foundation	Cleveland, OH	6 (6)	24 (25)
Henry Ford Hospital/Wayne State University	Detroit, MI	8 (2)	21 (19)
Baylor College of Medicine	Houston, TX	6 (3)	21 (17)
University of California (San Francisco)	San Francisco, CA	4 (0)	21 (20)
Cedars-Sinai Medical Center	Los Angeles, CA	2 (2)	21 (22)
University of Washington	Seattle, WA	2 (3)	21 (22)
Stanford University	Stanford, CA	12 (8)	18 (14)
University of Maryland	Baltimore, MD	8 (5)	18 (13)
National Capital Consortium	Bethesda, MD	4 (2)	15 (12)
Jackson Memorial Hospital Jackson Health System	Miami, FL	4 (4)	14 (14)
Brown University	Providence, RI	4 (4)	12 (13)
Wake Forest University School of Medicine	Winston-Salem, NC	4 (3)	12 (12)
Oregon Health & Science University	Portland, OR	10 (8)	10 (11)
George Washington University	Washington, DC	4 (4)	9 (7)
Louisiana State University (Shreveport)	Shreveport, LA	4 (4)	9 (7)
University of Rochester	Rochester, NY	3 (3)	9 (9)
University of Missouri at Kansas City	Kansas City, MO	2 (2)	9 (8)
VA Caribbean Healthcare System	San Juan, PR	2 (1)	6 (6)
University of New Mexico	Albuquerque, NM	4 (4)	6 (3)

Source: https://www.acgme.org/ads/Public as of November 21, 2012.

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Table 4
Critical care medicine training programs—CCM predominant

Program name	City, state	CCM positions approved (filled)	PCCM positions approved (filled)
UPMC Medical Education	Pittsburgh, PA	21 (21)	21 (18)
College of Medicine Mayo Clinic	Rochester, MN	20 (22)	15 (14)
Mount Sinai School of Medicine	New York, NY	17 (18)	19 (13)
Albert Einstein College of Medicine	Bronx, NY	13 (12)	12 (12)
St Louis University School of Medicine	St Louis, MO	13 (13)	6 (6)
Cooper Medical School of Rowan University; Cooper University Hospital	Camden, NJ	10 (10)	6 (5)
Memorial Sloan-Kettering Cancer Center; New York Presbyterian Hospital	New York, NY	10 (10)	–
National Institutes of Health Clinical Center	Bethesda, MD	8 (5)	–
Maimonides Medical Center	Brooklyn, NY	6 (6)	–
Dartmouth-Hitchcock Medical Center	Lebanon, NH	5 (2)	3 (3)
Hennepin County Medical Center	Minneapolis, MN	5 (4)	–
Baystate Medical Center; Tufts University School of Medicine	Springfield, MA	4 (4)	–
Geisinger Health System	Danville, PA	4 (4)	–
Orlando Health	Orlando, FL	4 (4)	–
Seton Hall University School of Health and Medical Sciences	Newark, NJ	3 (2)	–

Source: https://www.acgme.org/ads/Public as of November 21, 2012.

disciplines. Eliminating artificial barriers such as multiple-fellowship requirements for IM training programs may allow increase in fellowship complement, as discussed above. In addition, requirements that IM-based fellows must spend a fixed, predetermined amount of time in a medical ICU should be reevaluated. Furthermore, it is unclear if a member of a stand-alone CCM training program has ever been asked to sit on the IM-RRC. Adding a faculty member from one of the CCM only programs to the IM-RRC may help to address discrepancies seen in critical care curriculum between PCCM and CCM. In addition, a CCM member to the IM-RRC may also help to address the differences between IM, surgery, and anesthesia critical care training curricula, as well. This can include discussing current limitations on critical care specialists from other disciplines from being KCF and excess emphasis on bronchoscopy as compared with other relevant critical care procedures.

Lastly, it may be time for the leaders of CCM and the ACGME to readdress the concept of one common pathway toward competency and certification in the care of the critically ill. As the care of critically ill becomes increasingly complex and specialized, additional time in training may be needed to cover all aspects of becoming an intensivist. This may not be feasible with the current limited time in critical care training from surgery, anesthesia, or IM fellowships. Thinking "outside the box" may entail creating a new hospital-based residency in CCM for the United States, as is done in some other countries. This novel concept is not new and has been discussed previously [36]. In addition to gaining knowledge to treat all aspects of critical care, graduates would also have to gain competency in procedural skills that were once the domain of various specialties but are now being commonly performed in the ICU. Such skills include percutaneous tracheostomies (once the domain of surgeons), transesophageal echocardiograms (once the domain of cardiologists), and continuous renal replacement therapy (once the domain of nephrologists), to name a few.

Despite advances in technology and medicine, nothing affects the outcome of a critically ill patient more so than the use of an intensivist. It has been greater than 10 years since Angus et al [4] warned of the pending shortage of full-time intensivists in the United States. Short-term fixes such as virtual ICU, extenders, and hospitalists may help alleviate the shortage, but long-term solutions with a greater focus on increasing the number of full-time intensivists are long overdue.

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