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Elevating the human condition during times of emergency

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The 2020 COVID-19 Pandemic: Front-line Perspectives Through Different Lenses

Wendy C. Coates, MD

“COVID-19 ... has pushed emergency medicine to do what we do best, rapidly assessing and responding to crisis.”—Angela Mills, MD

News and information about the 2020 SARS-CoV-2 COVID-19 pandemic are plentiful. We are bombarded with data and often conflicting statistics, trends, and emerging clinical studies to evaluate and treat the virus through scientific journals, the news media, and social media. Human interest stories, frequently centered on patients, abound. Physicians permeate the national media scene to educate the community and governmental officials about the facts and alert them to critical needs for increased research funding, access to personal protective equipment (PPE) and about the importance of social distancing to curb the spread of COVID-19. Ordinary people now use terms such as “flatten the curve” and “R-naught.”

What is missing from the news stories? Physicians are experiencing inconceivable challenges that affect their daily routines, academic career advancement, mental health, and sometimes, even their survival. In this issue of AEM Education & Training, we explore a continuum of first-person perspectives of physicians on the front line who are battling the challenges of the pandemic. Each contributor is at a different career stage, and although their individual challenges may appear to be very different, there is a consistency in the underlying message, one that underscores the unrelenting commitment of emergency physicians to serve their communities, innovate, and support one another.

Medical students in their clinical phase of study were advised to curtail clinical activities. Benefits of this decision include decreased exposure to the virus for novice trainees, preservation of scarce PPE, and reduced time demands on academic faculty who have expanded clinical workloads. Given the tight schedule in usual times, this decision may create additional challenges for residency match and graduation. Shamapant describes the ambiguity of his current role and details of the future, yet notes that “… medical students share a sense of purpose and common struggle that is only more unifying in the face of this upheaval.”

Of all the physicians in the emergency department, residents generally work the most hours. Not surprisingly, they are likely facing physical and emotional exhaustion at an intense level while they continue their postgraduate education. PPE shortages affect them daily, and once familiar routines are adapted to ensure their safety. Bennett and his co-residents are dealing with prematurely disquieting tasks, like executing their own advanced directives and health care proxies, prompted by witnessing infected patients of their age succumb to COVID-19. He sums it up by saying, “Hoping for the best, we have prepared for the worst.”

Academic faculty are charged with shaping the careers of trainees and participating in scholarly activities while also remaining clinically adept. Relying on evidence-based medicine as a guideline for teaching and practicing is standard. However, as Dubosh points out, “COVID-19 had officially transformed our world, and the realities began crashing down on...”
our old paradigm of training.” Feeling responsible for the safety of her residents, she was conflicted about involving them in high-risk airway management, which they pointed out was a necessity in their training. She had to modify her academic activities, including teaching, mentoring, and conducting research on electronic platforms. Undaunted and true to her mission, she states, “Although answers are in short supply, what is clear is our need to continue to persevere as academicians and train the next generation of physicians.”

The challenges of the emergency medicine (EM) department chair’s role are intensified in times of crisis. These challenges are accentuated when the chair is afflicted by the very disease that is at the root of the pandemic. Nevertheless, Mills, a chair of a major academic department in hard-hit New York City, called upon familiar leadership skills and applied them directly to combatting the challenges her department faced. She points to the value of interpersonal relationships across the entire spectrum of the pandemic, and hopes “… that we continue these acts of kindness and collaboration not only during this prolonged crisis, but also after.”

The perspective of an emeritus faculty member who has traversed all of the career stages included in this series advises us that academic EM is a series of transitions. Hockberger shares that “… the most important lesson I’ve learned is that we are ultimately defined more by how we manage those transitions, and how we treat the people we meet along the way, than we are by the professional accomplishments that bring us recognition and awards.”

Although each of the authors whose perspectives are featured in this series are at vastly different stages of their academic EM journey, all emphasize that it is through interpersonal connections that they are surviving and growing during this pandemic. Creativity and collaboration at each stage inspire systemic success. The specialty of EM has what it takes: anyone, anything, anytime.

References
As a third-year medical student who was on the inpatient medicine wards when the pandemic broke out, my life is jarringly discontinuous with what it was before. While I know many students have returned to their education in some form online, there is no replacement educational experience for being on the wards. One week I was waking up before sunrise to preround on patients, managing aspiration pneumonia and alcohol withdrawal, and feeling like a member of the medical team. The next week, I was at home in my pajamas, wishing my team good luck and hoping for some kind of news, some kind of certainty.

That was mid-March. Since then, some areas of life have become more certain and others remain ambiguous. My role in the day to day of this pandemic has become clearer with time. While it made little sense to have medical students on the wards with limited personal protective equipment and a directive to minimize exposure, our student body responded rapidly and with unity to meet the needs cropping up around our health care system. They say that true character is revealed under duress, and the medical student response to this situation has been telling. It is characteristic of our field that upon being given a 3-month respite from daily work due to a global health care crisis, the medical student body quickly reoriented, finding a plethora of ways to support the hospital. For me, this has ranged from volunteering at our free clinic, delivering medications and conducting telehealth visits, to volunteering at the pharmacy to many other tasks that crop up day to day. The health care system had to adapt, and as medical students we have adapted with it.

Our professional situation, however, remains ambiguous. As a medical student, my life is orchestrated by a curriculum planned well in advance by our medical school administration. It isn’t just that the medical student curriculum is typically so crowded, it’s that the upcoming months felt necessary. There are core clerkships to complete, board exams to prepare for, and graduation requirements to meet. The timeline seemed precariously ordered, culminating in a residency match the following year. When clerkships were canceled, I felt lost not only with absence of day-to-day structure, but also with uncertainty about the trials the coming months would bring. Each town hall with our medical school administration feels like an extraordinary event, around which the ground could shift as graduation requirements and schedules significantly change. We are in good hands with our school leadership, who have heroically paved a path for us in historically unique times. However, never before did life feel this far outside of my control.

Having perspective in times like these can be difficult. These moments can make us feel small. Sometimes, I feel a guilty relief as the weight of minor personal concerns drowns in the significance of the tragedy happening around me. Other times, simple acts such as asking for career advice from mentors who are risking their lives on the frontlines can feel overbearing. For students still deciding their medical specialties, where those crucial three more months of experience may have made a significant difference, this is harder still. As the pandemic era lasts longer and longer, I have found it increasingly important to retain a feeling of value and avoid trivializing my own aspirations.

In spite of this uncertainty, there are silver linings. Through our efforts, I do believe we are making a significant difference, and along the way I have had a
myriad of new experiences. As part of my volunteering, I have seen nooks and crannies of the hospital to which I would never have otherwise had access, ranging from the administrative headquarters to the clinical bioengineering department to the pharmacy. As a community, our identity has also held strong. I feel that medical students share a sense of purpose and common struggle that is only more unifying in the face of this upheaval.

Looking forward, I find myself beset by contradictory feelings. The prospect of facing at least 2 months, perhaps longer, until clerkships resume, is daunting. It leaves an open space in our lives that begs for structure. Yet despite this expansiveness, there is urgency in everything we do, a feeling that every little thing matters. Every day I see evidence of my peers and mentors working diligently in new efforts to bolster the barricades and push back against this pandemic with whatever effort they can muster. Their efforts remind me of both the capacity we have to make a difference and why I joined the medical profession in the first place. While much uncertainty remains, and the coming months will bring more trials to overcome, I have never been prouder to be a medical student.
My shifts all start the same way these past few weeks with the collection of my allocated face shield and N95. The same shifts where it feels like the only patients I treat are those with COVID-19. Faces sometimes not much older than mine. Patients who are tachycardic, hypoxic, and ill. But these interactions are different; physical exams completed under the supervision of a colleague just outside the room, charged to watch my every movement. Vigilance not just for me but for everyone else I could and would come into contact with over the course of my shift. COVID-19 lingers on cardboard, steel, plastic, and other surfaces. Even the simplest of acts are dangerous without appropriate precautions.

Precautions helped in some small part by my newfound ritual of talking out loud to myself as I stepwise walk through donning and doffing. Making sure my “soiled” PPE comes off just right. That the outside sleeve of my gown does not brush my scrubs. And that I do not inadvertently touch my face while removing my N95. I cannot tell you how many times these past few weeks I have stopped my hand on its way to my face. An unfortunate, reflexive attempt to push my glasses up that in recent days led me to opt for contacts instead. The glasses now stay at home along with my watch and wedding ring. A difficult decision, but one that means less of an opportunity to take COVID out of the patient’s room or worse—home to my husband.

My coresidents tell similar stories. Newly acquired rituals inside and outside the emergency department. Modifications to the muscle memory of our daily routines all based in the hope of keeping the virus contained. One colleague in particular, appropriately fearful of bringing COVID-19 home to his small child, strips in the hallway before walking through his apartment door, a postshift act he is quick to convey he will keep doing until his neighbors encourage him otherwise. We do not blame him. We too would be devastated if we were to get our loved ones sick.

Although said with humor, but understood to be laced with fear, these not so small adjustments are reminders of how COVID-19 has changed what we do and how we do it. The hand sanitizer goes more quickly. People get creative in how they open doors. A sneeze sends staff scurrying and a cough causes a head to raise, a scowl to form.

Last week a physician described how he was washing his hands so much, and for so long, that they were becoming irritated and blistered. He needed recommendations on how to keep his patients safe—but his skin intact. Some of my colleagues upstairs, internal medicine residents in the ICU, took things a step further. On a recent overnight shift together, they signed health care proxy forms naming loved ones who would make decisions for them if they became infected and were too sick to do it themselves. The next day I did the same. It seems far too morbid of a task to do so young. But then again, the faces of some of my patients are not much older than mine. And doctors—residents—have already died.

COVID-19 continues to spread. At first, we heard the stories; the burden of death and disease our colleagues faced in China. Then we read the recounts of our Italian counterparts and saw the bruised faces of their health care workers. Tight masks leave marks, but only if you have masks. We saw how their system was pushed. Hard and fast and over the edge. Too many sick patients and too few resources for them. Colleagues in Washington foreshadowed what we now see on a daily basis. Sobering stories from New...
York are now becoming our own. Unable to sleep last night, I found myself rereading one of the updates\(^5\) on COVID-19 from the Surgeon-in-Chief at New York–Presbyterian Hospital and Columbia University, Dr. Craig Smith. A city not so far from here.

Dr. Smith opened this particular update with the want to offer comfort, but instead being only able to offer alarm. An influx of more patients, sicker patients. Made worse by a dwindling supply of PPE. Reading along, Dr. Smith painted a grim picture of what his hospital was seeing. A picture I hope we are able to avoid; but one that I worry we won’t. A picture our hospital has spent the past several weeks and months preparing for. A worry that keeps me up at night. Hoping for the best, we have prepared for the worst.

References


COVID-19: A Faculty Educator’s Perspective

Nicole M. Dubosh, MD

It first hit me on March 17. After a long weekend off, I arrived for my 7 AM ED shift, a department where I had worked for almost 9 years and an environment I knew like the back of my hand. In the 5 days since my last shift, there had been drastic changes. Patient room curtain partitions had been replaced by makeshift aluminum walls. A doffing and donning area had sprung up in the hallway at the entrance to our former observation unit, now a COVID hot zone. The lobby coffee shop where I stopped for my daily caffeine fix was closed and had been pushed aside to make way for another respiratory evaluation zone. The reality of not having enough personal protective equipment (PPE) hit hard as our supply of N95s was moved behind lock and key and I was given my brown paper bag to store my single allotted mask between shifts. Our M&M conference and resident didactics were moved to video streaming. That afternoon, the Association of American Medical Colleges announced that all that medical students’ clinical rotations should be paused, indefinitely. COVID-19 had officially transformed our world, and the realities began crashing down on our old paradigm of training.

When my residents ask the “right” way to manage our COVID-19 patients, I pause. My tried and true ability to recount the latest literature and best practices is no longer relevant. There are no randomized controlled trials. There is no textbook on this disease. We are learning as we go and writing as we speak. During the first 2 weeks, we were intubating early. How could we justify not intubating a patient with an O2sat of 68% on arrival? Then, we shifted to awake proning, recommended by our colleagues in New York as potentially effective. Now, we are seeing concomitant thrombotic manifestations including large-vessel strokes in young people with COVID-19. As I explain to my residents, the best advice I can offer is to look at the patient and do what you think it right. Hypoxia and tachypnea shouldn’t go home. That is my only hard rule ... this week. Unfortunately, I cannot tell you the evidenced-based clinical guidelines right now. They currently don’t exist.

Learning how to balance what is best for my patients, residents, and myself remains a continuous challenge. When I walk into the room of a coughing patient who is unable to keep a mask in place, I question what benefit I will gain by auscultating his lungs and weigh this against the risk of getting viral particles on my exposed neck and hair. We don’t know how long the viral particles last or the inoculum needed to infect us. I vividly recall my first COVID-19 intubation last month. As the most experienced physician on the team, my initial plan was to perform this high-risk procedure myself to avoid an unnecessary exposure for my resident. That was immediately met with resistance, as he reminded me that this is his training and he needs to learn. I don’t know the right answer, but I let him do the intubation. Unfortunately, COVID-19 is here to stay for the foreseeable future and training our residents must continue.

Four months ago, I was starting to feel like my academic career was truly hitting its stride. Now, most of my scheduled national and international talks have been canceled. Last month, I gave my first Grand Rounds to another academic department ... sitting
alone in my office and streaming it via Zoom. Sure, I
delivered the content, but I was unable to experience
the excitement of the event. Most of my current medi-
cal education research projects involving simulation
and clinical encounters are paused indefinitely given
social distancing restrictions and new institutional poli-
cies. My medical students have now been out of
patient care areas for over a month. This week, I am
shifting my efforts to plan for the long term. I have
Zoom meetings scheduled to advise students applying
to emergency medicine and to discuss the possibility
of transitioning the student clinical clerkship to an
online forum—both concepts being uncharted terri-
tory for us in medical education. I am regrouping with
my incoming education fellow on a new academic pro-
ject, as her in situ simulation research study we
intended to launch in July is no longer possible.
Although answers are in short supply, what is clear is
our need to continue to persevere as academicians
and train the next generation of physicians. The solu-
tions will certainly not be straightforward, but I am
curious to see how we will adapt.

In the 6 weeks since March 17, I have constantly
reflected on what it means to be an emergency
physician. In some ways, this is exactly what we signed
up for: serving on the frontlines during a time of crisis
and actively saving lives. We have quickly risen to
hero status in the eyes of society and the rest of the
medical community. As I watch my friends and family
attempt to work at home in isolation in positions that
may or may not exist for much longer, I am thankful
I still have a job and a paycheck. I look forward to my
clinical shifts in the ED, where seeing my work friends
has become my primary social outlet in the era of
quarantine, a luxury many do not currently have. On
the other hand, I never imagined a career in which I
would have constant anxiety about a diminishing PPE
supply and putting my life at risk. I see health care
systems cutting salaries and furloughing emergency
physicians due to the precipitous decline in ED vol-
ume. When I watch the news, I find it infuriating to
see expert evidence-based recommendations by some
of the smartest minds in our country blatantly disre-
garded. I wonder how and if medical education will
shift going forward. While so many things remain
unclear, it is becoming more apparent this is not short
term, and because of that, all we can do right now is
work to adapt and adapt to improve.
When I was interviewing for chair positions 3 years ago, a few chair colleagues across the country warned me this job was a lonely one. I understood as a chair you cannot maintain work friendships like those I once cherished, that people see and treat you differently because you are their boss, that due to the importance of privacy conversations are sometimes limited to maintain confidentiality, and that you are ultimately responsible for factors that may be beyond your control. My first 2 years as chair in a new organization, in a new city, were filled with extensive listening, learning, challenges, and accomplishments: starting a new academic department at a renowned institution, hiring 47 new faculty members and 37 administrative staff, adding a fourth clinical site, expanding the educational and research missions. Then, just a few weeks after what then felt like a monumental change, the implementation of a new electronic health record, COVID-19 emerged.

COVID-19 has been a crisis like no other, stretching all of us in ways we never before imagined. As an emergency physician for over 20 years, I experienced a new first as I witnessed the heightened level of uncertainty and anxiety which surrounds this illness, much of it due to the many early unknowns of COVID-19 in its presentation and disease progression. We spent countless hours in discussion and preparation regarding staffing, resources, alternate care areas, and wellness, while guidelines and recommendations concerning personal protective equipment (PPE), testing, and disease management were changing daily, even hourly. The numbers of severely ill patients rose dramatically over a few weeks to our peak of COVID-19, with over 20 patients being intubated daily at our university site and more end-of-life discussions and emergency department deaths than some may see in a career span.

After spending the weekend with my family in mid-March, a sore throat, myalgias, cough, and shortness of breath led to my self-quarantine. As a New York City chair in the epicenter of this crisis, I was challenged by the pandemic and the new stresses it created in my role: being able to adequately advocate for resources needed; maintaining the safety and well-being of our faculty, trainees, and staff; and sustaining the 16- to 20-hour work days that were just not long enough to address everything requiring attention. I was feeling significant guilt of being sick and unable to be present on site, round in the ED, and look into the eyes of our team members to try and assess how they were doing behind their masks and PPE. The proverbial weight of this stress was compounded by the weight of COVID-19 symptoms I was experiencing. During my brief hospitalization, one of my colleagues texted me (and then my husband) threatening to come take my phone away so that I could take a day off and rest. Despite the frequent vital sign checks, I slept better on the medicine ward than I had in weeks. As I have been reflecting on some of the key leadership skills I have valued during this crisis, like all things, I find they are similar to the ones we rely upon during normal times.

EMPATHIC LISTENING

During this time of incredible uncertainty, we established frequent departmental virtual huddles for two-
way communication providing information while also encouraging feedback and suggestions in a safe environment. As fears increased related to acuity and the projected numbers of intubated patients, we heard from our group that adding the number of available institutional ventilators to our daily e-mail communications would help to alleviate some anxiety and ambiguity. As we listened to the team’s frustration with their inability to eat and drink due to PPE and infection prevention measures, we converted a conference room into a “clean” lounge stocked with drinks, snacks, and daily donated meals. It was essential to not only think about our patients, but the people who are taking care of them. We brought together the talent of our faculty and administrative teams to provide a supportive environment in which they could continue to thrive and do their amazing work.

**TRUST**

To be effective, especially during a crisis, leaders need to both trust and be trusted by their team. While building trust may take some time, the inability to trust others as a leader can be paralyzing as no one can do everything on their own. As chair, I had to trust my team to give their best and execute their own action plans. This allowed me to function and have the capacity to guide, to provide reassurance, and to resolve conflicts when they arose.

**FLEXIBILITY**

In our clinical work fighting COVID-19 there was a fluidity necessitating frequent change. To innovate, be creative, and consider the situation through a number of mental models, we had to be flexible. Our telehealth team pushed the envelope with limited resources and developed a new nurse-free model of care using our virtual providers. Our operations team found various alternate care spaces working with hospital facilities’ personnel adding monitoring and oxygen in new environments. We were proactive and willing to invent new solutions for our patients and staff.

**COLLABORATION**

COVID-19 fostered working together in an unprecedented fashion and speed with other departments, services, and hospitals. This included creating a greatly needed and utilized ED-based palliative care service, partnering with our health system’s sister hospitals to develop system-wide evidence-based guidelines, and developing a program to safely discharge patients with mild hypoxia. We could not have been as successful without collaboration. We learned that it is more effective to overcollaborate rather than to outcompete when in a crisis.

**WELLNESS**

I worry for our community. We have been stricken by so much tragedy, anxiety, and trauma. We are all in far greater need of mental health care, support, and wellness resources. We know the dangers of our profession at baseline on our staff, but in times of crisis this is heightened. All of us need to check in with those around us both in our professional and personal lives. The new normal of masks that cover our expressions, social distancing, and video meetings has changed our human interactions. We owe it to each other to ask how our colleagues are coping and processing their own emotions and not become accustomed to our new physically separate world.

As a “lonely” chair in isolation for weeks, I witnessed so many remarkable acts of kindness personally (well wishes and delivery of home-cooked meals and groceries to my apartment) as well as in general (nightly 7 PM cheering of New Yorkers with cow bells and all, countless donations of food and PPE, a hair stylist’s courage donating his services to allow our physicians to bring their best selves to work, chairs of other departments working 12-hour shifts in our department to help). There has been a new-found level of collegiality born from coming together in a time of crisis, working in someone else’s shoes, and rising up to accomplish new things together. I ask and hope that we continue these acts of kindness and collaboration not only during this prolonged crisis, but also after. Continued acts of kindness and empathy will be needed as we enter a new phase of living with the downstream impact of medical and mental health outcomes for both our patients and our colleagues. We will need to be stronger for longer. Our collective strength, collaboration, and kindness unified us through this first phase of COVID-19 and will undoubtedly allow us to succeed in navigating the phases ahead.

We are changed. COVID-19 has changed me personally and as a leader. It has pushed emergency
medicine to do what we do best, rapidly assessing and responding to crisis. We have learned lessons, demonstrated the tenacity of our specialty, mourned together, collaborated across departments, and showered kindness on one another. The future will require continued navigation of new challenges, and our experiences through this crisis will allow us to prepare for success as we move forward.
COVID-19: An Emeritus Faculty’s Perspective

Robert S. Hockberger, MD

Life in academics often seems like an endless series of transitions: from medical student to intern, from junior resident to senior, from fellow to faculty, from junior faculty to senior, and sometimes from local leader to national figure. Looking back now on my own career and those of others, the most important lesson I’ve learned is that we are ultimately defined more by how we manage those transitions, and how we treat the people we meet along the way, than we are by the professional accomplishments that bring us recognition and awards.

Transition periods define us because embarking on journeys down unknown paths can be both frightening and stressful. Navigating those paths successfully requires inner strength, resolve, humility, and the willingness to learn and hopefully grow, from each new challenge, and each new relationship we develop. Focusing on the journey, and what it offers in terms of personal and professional growth, makes undertaking new tasks, even apparently insurmountable ones, both less daunting and more satisfying.

Glenn Hamilton, a former department chair and leader in academic emergency medicine, once said that “sometimes we contribute in big ways, sometimes in small ways, but we contribute nonetheless, because that’s what matters.” I have often thought about those words and have learned that helping others discover how they can best contribute, in large ways and small, given their individual skills and desires, is a wonderful and rewarding role for anyone, at any stage in their career.

Many of you have recently had to focus on an unexpected and seemingly insurmountable crisis instead of the graduation or other exciting transitions you had anticipated. My wife and I are 71 years old, staying home, doing what we can for our local community, and praying for you.

Is there anything you can do, right now, to help better prepare for life following the pandemic? You might focus on your relationships with each other and with every person you encounter on every shift you work in the ED: patients and their families; medical, nursing, and ancillary staff; and anyone else who crawls, walks, or rolls through the door. Every one of them is frightened and in need of understanding and support, and many want to contribute in some way. While most of us like to think that we lead lives that focus as much or more on others than ourselves, that is rarely the case and particularly challenging at times of crisis. Taking a few moments, when you can, to make a conscious effort to reassure a patient or family member, or thank a staff member, or support a colleague, or teach someone something is sorely needed at this time. It is also a wonderful habit to form and hone as you try to navigate your personal transition from the current crisis to the next stage of your career.
Which Applicant Factors Predict Success in Emergency Medicine Training Programs? A Scoping Review

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ABSTRACT

Background: Program directors (PDs) in emergency medicine (EM) receive an abundance of applications for very few residency training spots. It is unclear which selection strategies will yield the most successful residents. Many authors have attempted to determine which items in an applicant’s file predict future performance in EM.

Objectives: The purpose of this scoping review is to examine the breadth of evidence related to the predictive value of selection factors for performance in EM residency.

Methods: The authors systematically searched four databases and websites for peer-reviewed and gray literature related to EM admissions published between 1992 and February 2019. Two reviewers screened titles and abstracts for articles that met the inclusion criteria, according to the scoping review study protocol. The authors included studies if they specifically examined selection factors and whether those factors predicted performance in EM residency training in the United States.

Results: After screening 23,243 records, the authors selected 60 for full review. From these, the authors selected 15 published manuscripts, one unpublished manuscript, and 11 abstracts for inclusion in the review. These studies examined the United States Medical Licensing Examination (USMLE), Standardized Letters of Evaluation, Medical Student Performance Evaluation, medical school attended, clerkship grades, membership in honor societies, and other less common factors and their association with future EM residency training performance.

Conclusions: The USMLE was the most common factor studied. It unreliably predicts clinical performance, but more reliably predicts performance on licensing examinations. All other factors were less commonly studied and, similar to the USMLE, yielded mixed results.

Selecting residents for a graduate medical education (GME) training program is a difficult task. The average emergency medicine (EM) program receives 940 applications for 11 first postgraduate year (PGY-1) positions.1 Programs typically rank 12.8 applicants per PGY-1 position,1,2 investing considerable time and resources in the screening, reviewing, and interviewing of medical student applicants.

When deciding where an applicant should fall on a program’s rank list, a program director (PD) may consider many factors in their decision, such as clerkship grades, United States Medical Licensing Examination

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(USMLE) scores, Standardized Letters of Evaluation (SLOEs), or an applicant’s potential to contribute to the program and the community.\textsuperscript{1} It is difficult to predict which selection strategies will cull the most successful residents.

Residency programs aim to build a strong cohort of residents who will become successful physicians. The definition of a “successful” resident is controversial\textsuperscript{1,3} but may include one who is clinically competent, as measured by the Accreditation Council of Graduate Medical Education (ACGME) core competencies\textsuperscript{4} and milestones,\textsuperscript{5} or one who successfully passes board qualifying examinations.

Several studies across all specialties have analyzed which applicant qualities are most predictive of future resident performance. For example, one multidisciplinary single-institution study found that student’s class rank or quantile on the dean’s letter, now known as the Medical Student Performance Evaluation (MSPE), predicted intern performance.\textsuperscript{6} Another study in orthopedic surgery found that USMLE Step 2, number of clerkship honors, and Alpha Omega Alpha (AOA) membership strongly correlate with objective and subjective measures of resident success.\textsuperscript{7} However, the qualities that predict a successful internal medicine or orthopedic resident may not predict success in EM. Multiple studies have attempted to analyze the predictive value of specific EM resident selection strategies.\textsuperscript{8–34} Some studies have reported the relative importance PDs place on each factor during the selection process, but these are based on opinion.\textsuperscript{35–37} A recent review studied selection factors as they related to resident performance for all specialties,\textsuperscript{38} but no comprehensive review has evaluated the predictive value of selection factors specific to EM residency performance. The purpose of this scoping review is to examine the breadth of evidence related to the predictive value of selection factors for performance in EM residency.

**METHODS**

After ensuring that no other systematic or scoping review on this topic had been performed, the authors conducted a scoping review to establish a narrative of which resident selection items forecast a successful EM resident. The objectives, inclusion criteria, and methods for this scoping review were specified in advance and documented in a protocol and can be found in Data Supplement S1, Appendix S1 (available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10411/full).

We used the scoping review methodology first proposed by Arksey and O’Malley\textsuperscript{39} and further revised by the Joanna Briggs Institute\textsuperscript{40} to address our study objective. We then incorporated the guidelines delineated by PRISMA Extension for Scoping Reviews: Checklist and Explanation into the appendix table (Data Supplement S1, Appendix S2).\textsuperscript{41} Quality of literature appraised using the STROBE Statement checklist and represented as a percentage of the total possible score.\textsuperscript{42}

**Eligibility Criteria (Inclusion Criteria)**

Participants in each study are residents or graduates of EM residency programs in the United States. The included studies are published papers, abstracts, and available unpublished papers correlating one or more selection factors from medical school (e.g., USMLE scores) or the start of residency (e.g., factors assessed during the first month of residency intended to act as a surrogate for medical school factors) with performance outcomes during or after EM residency training. Residency programs included in this study are 3- or 4-year EM residency programs that were formed in or after 1970 and are accredited by the ACGME or the American Osteopathic Association.

**Information Sources (Search Strategy)**

We comprehensively searched PubMed, Scopus, ERIC, and Web of Science for publications of all study designs, written in English language, and pertaining to the U.S. programs from 1992 to February 2019. The librarian (LM) designed the search and applied the search strategy in each of the selected database. A complete PubMed search strategy is depicted as an example in Data Supplement S1, Appendix S1.

To identify gray literature, the authors searched four websites (Society for Academic Emergency Medicine, Council of Residency Directors in Emergency Medicine [CORD-EM], American College of Emergency Physicians, and Association of American Medical Colleges [AAMC]) for abstracts at national meetings written on the subject. For abstracts that met the inclusion criteria, we contacted the study authors to request a copy of their unpublished or published manuscript. We conducted the most recent search in February 2019. A complete search query for the PubMed database can be found in found in Data Supplement S1, Appendix S1.
Study Screening and Selection
Using our predefined inclusion and exclusion criteria, two reviewers (CG and AY) independently screened titles and/or abstracts of articles that met our search query. Interreviewer discrepancies were resolved by the senior investigator (MBO). There were approximately 16 articles out of the original 60 that required adjudication by the third author. After screening titles, we read the full text of articles to determine whether the study should be included in the final review. Following this, the reviewers screened the references and PubMed-related articles for all included studies. We ensured literature saturation by using the Google Scholar “cited by” and “relevant articles” feature for each included study.

Data Charting Process
We identified selection factor and outcome variable categories. We worked with a trained statistician (SS) to describe the relationship between each selection factor and each outcome variable.

RESULTS
We identified 1,725 studies through our electronic database keyword search. We screened an additional 21,566 abstracts. After removing duplicates, the reviewers screened a total of 23,243 article titles for study eligibility. We read the full text of 27 articles and 33 abstracts, ultimately including 14 papers and 13 abstracts in the review. We attempted to contact the study author for each of 13 abstracts to request the manuscript. We received one unpublished manuscript and one in press (now published) manuscript from these queries. In total, we included 15 published articles, one unpublished manuscript, and 11 abstracts (Figure 1).

The 27 included studies examined the following selection factor categories: standardized tests, letters of recommendation, MSPE, interview, medical school reputation, clerkship grades, audition elective, honor society membership, and other infrequently cited factors (e.g., sending thank you letters). Some authors studied whether the student’s position on the National Resident Matching Program (NRMP) rank order list (ROL) predicted success.

The authors of these studies defined success by the following: in-training examination (ITE) performance, passage of the American Board of Emergency Medicine (ABEM) Qualifying Examination (QE), or American Osteopathic Board of Emergency Medicine (AOEBM) written examination average ACGME core competency-based Likert-scale faculty evaluation scores, or a graduation rank order list (GROL). A GROL is a ranked list of graduates, as determined by a vote of faculty or program leaders, upon or after graduation, made specifically for the purposes of the study. Table 1 and Data Supplement S1, Appendix S2, list each included study, the selection factors they studied, the assessment method they used, and whether the selection factor was predictive or not significantly predictive of success in residency. Studies that correlated strong performance on a selection factor with strong performance

Figure 1. Flowsheet for inclusion and exclusion of studies in the scoping review.
during/after residency and studies that correlated poor performance on a selection factor with poor performance during/after residency are both represented/considered “predictive” in Table 1. Here we describe each selection factor and its predictive factor according to the published literature.

### Interviews

Two studies investigated traditional, nonstandardized interviews. Bhat and colleagues examined 277 EM residents from nine programs in a retrospective cohort study. They found that the interview score, during a traditional interview, was predictive of the outcome (black icons) even if they were only predictive in the univariable analysis.
one of several predictive factors for residency success, as measured by faculty evaluations at the end of residency. Hayden et al.,12 however, did not find a correlation between the traditional interview and overall residency success in 54 residents.

A standardized, behavioral interview was explored by Thaxton and colleagues,17 who interviewed 106 first-month interns from a single institution over 8 years. The authors coded interns’ responses to the question “Why is medicine important to you?” as “self-focused” or “other-focused” (e.g., “I enjoy the challenge” vs. “I enjoy helping patients”). A higher proportion of residents who gave “self-focused” answers underwent remediation during residency than did those who gave “other-focused” answers.

Only one study in EM has tested the predictive value of the multiple mini interview (MMI). Burkhardt and colleagues10 sought to determine whether the MMI would provide additional value beyond other traditional selection factors. They administered an eight-station MMI to 65 interns at three programs during their first month of residency. On a univariable analysis, the MMI correlated with overall performance at an end of intern year ACGME core competency-based assessment. However, it failed to remain in the model when studied with other selection factors in a multivariable analysis.

The standardized video interview (SVI) was developed by the AAMC and introduced to EM during the 2017 to 2018 application cycle.43,44 At the time of publication, no studies had examined whether the SVI could predict future performance. In October 2019, the AAMC announced that they would discontinue use of the SVI for EM in the 2020 to 2021 application season.45

Medical School Attended

Hayden and colleagues12 retrospectively studied 54 residents over a 9-year period from a single residency program. They found that the competitiveness of the medical school attended (MSA), as measured by published medical school ratings and faculty experience, was the strongest predictor of overall success at the time of graduation. Burkhardt et al.10 found MSA was one of several applicant factors that correlated with end of internship performance in the multivariable analysis; however, Bhat et al.8 did not find a statistically significant correlation between MSA and resident performance.

Audition Elective and Emergency Medicine Clerkship Performance. Wagner and colleagues20 reviewed 93 residents from four California residency programs and found that matching into the program at which a student completed an EM clerkship “audition rotation” correlated with strong performance during residency. Bhat et al.8 found an association between students receiving honors grades on EM clerkships and top-third performance at the end of residency. At the end of internship, Burkhardt et al.10 did not find a similar correlation with overall performance.

Standardized Tests

Twenty-one studies examined the relationship between standardized tests during medical school and resident performance in EM.8–14,18–20,22,23,25–34

USMLE and Clinical Performance. Several studies found mixed results as to whether the USMLE is associated with clinical performance during residency, as measured by core competency-based assessments or a GROL. Bhat et al.8 found that USMLE Step 1, but not Step 2, correlated with being classified in the top one-third of one’s residency class; however, it was not as strong a predictor as other variables, namely, EM rotation grades, AOA designation, and publications. Burkhart et al.10 and Hayden et al.12 found similar correlation between USMLE scores and performance. However, other similarly sized studies found different results. Van Meter and colleagues19 examined 286 residents from five EM programs to determine the correlation between USMLE Step 1, ITE scores, NRMP ROL, and GROL and did not find correlation between USMLE Step 1 performance and GROL, nor did Wagner et al.20 Several abstracts and an unpublished manuscript yielded mixed results for both examinations.23,26,27,32

Bohrer-Clancy and colleagues9 retrospectively studied 260 residents over a 19-year period at a single institution to determine whether selection factors are associated with negative outcomes during residency, as defined by formal letters of deficiency, letters of reprimand, extension of residency (due to academic reasons), or failure to finish residency.9,46 They found that a failure on the USMLE Step 1 correlated with adverse outcomes during residency, in the univariable analysis, but this did not hold true in the multivariable analysis; results for Step 2 were not significant.9
USMLE and ITE Performance. The relationship between the USMLE and the ITE or ABEM QE performance appears to be stronger than that of clinical performance. Thundiyil and colleagues retrospectively examined 51 residents from a single program and found a correlation between USMLE scores and mean ITE scores, with moderate correlation for the USMLE Step 2 and mild for Step 1. Hiller and colleagues observed 62 interns from six residency programs to determine if first-month intern performance on a National Board of Medical Examiners (NBME) EM Advanced Clinical Examination (ACE) correlated with ITE scores. After reporting significant association between EM-ACE and ITE score, the authors also found a significant association between ITE and USMLE 1 and USMLE 2 in univariable analysis, but USMLE Step 2 failed to remain in the model in the multivariable analysis. Van Meter et al. found weak positive correlation between USMLE Step 1 performance and ITE performance in a multilevel model. Several abstracts have shown a positive relationship between Step 1 and/or Step 2 and the ITE, but none were published manuscripts at the time of this study.

USMLE and ABEM QE Performance. Har mouche et al. retrospectively studied 197 residents from nine EM programs and found that residents who passed the ABEM QE on first attempt (n = 187) had higher mean USMLE Step 1 and Step 2 scores than those who failed (n = 10; 206 vs. 220, Step 1; 229 vs. 203, Step 2). Residents who passed both the QE and the oral examination had a statistically significantly higher mean USMLE Step 2 than those who failed either examination on first attempt (229 vs. 201); USMLE Step 1 scores were not statistically significant. These results are supported by one abstract by Nelson and Calandrella, which found statistically significantly higher USMLE scores for those who passed the ABEM QE (207 vs 220, Step 1; 208 vs 228, Step 2). A study of 101 residents from two programs found that a score cutoff seven points below the USMLE national mean yielded 64% sensitivity and 81% specificity for passage of the ABEM QE on first attempt.

Comprehensive Osteopathic Licensing Examination. Li et al. investigated 451 EM residency graduates who took the AOBEM Part 1 in 2011 and 2012 and found significant correlation between Comprehensive Osteopathic Licensing Examination (COMLEX) 1, 2, and 3 and AOBEM scores and passage. One abstract correlated COMLEX 1 and 2 performance for 86 residents with ABEM ITE performance.

Letters of Recommendation and Evaluation
In 1995, CORD-EM created a standardized letter of recommendation (SLOR), later renamed the SLOE in 2013. Prior to 1995, some programs utilized a preprinted questionnaire (PPQ), which was similar conceptually to the SLOR/SLOE. One study of 17 residents found that these PPQs predicted success during residency, as measured by a GROL.

Studies on the SLOR/SLOE have yielded mixed results. Burkhardt et al. did not find that SLORs predicted performance during intern year, as part of the multivariable analysis. Hayden et al. reported that LORs—assumed to be SLORs—were a significant predictor of success for applicants from non–top tier medical schools. Bhat et al., unexpectedly, found that the final two “ranking” questions (global assessment and competitiveness) on SLORs written by non–program leadership, not residency program leadership, correlated with resident performance at graduation. Bohrer-Clancy et al. found that of the four applicants who either had a red flag on a LOR/SLOR/SLOE or during a clerkship rotation, all had a negative outcome during residency. An abstract by Silverman et al. reviewed the SLOR forms from six interns at a single institution and found that the question pertaining to how highly an applicant would reside on a program’s match list correlated with EM intern overall performance.

MSPE, Class Rank, and Clerkship Grades
The MSPE is a summative evaluation of a student’s experiences, attributes, and academic performance during medical school. It usually contains a ranking statement placing the student’s overall performance into a quantile. Trail et al. and Hayden et al. found a correlation between MSPE rank and performance, with Trail et al. correlating higher GROL and overall assessment during residency with an “outstanding” category on the MSPE or clerkships in honors in internal medicine. Bhat et al., however, did not find significant association between the MSPE and core clerkship grades with performance.
Honor Society Membership
Bhat et al.8 and Trail et al.23 found that AOA designation was associated with higher performance during residency. Gold Humanism Honor Society membership, however, was not significantly associated with a top one-third performance.8 An abstract by Ahn et al.24 surveyed PDs and found that programs with greater than one-half of residents with AOA distinction performed higher on the QE and oral boards.

Other Factors
Distinctive Leadership. Hayden et al.12 examined “other distinctive factors” from a student’s application, such as athletic accomplishments or leadership involvement, and found that they predicted overall success in residency.

Objective Structured Clinical Examination. Wallenstein et al.21 studied 18 first-month interns’ performance on a five-station objective structured clinical examination (OSCE) and found that it correlated with performance 18 months later on ACGME core competency-based EM faculty global evaluations.

Publications. Bhat et al.8 found that publishing five or more presentations or publications before or during medical school was associated with a top one-third performance during residency.

Professionalism. The study by Bohrer-Clancy et al.9 reported that students who did not send interview thank you notes or had any leave of absence during medical school were more likely to have negative outcome during residency.

NRMP Rank. Several papers and abstracts evaluated the predictive ability of a resident’s position on a program’s NRMP rank for performance, finding mixed results. Sklar et al.16 studied 20 residents from a single institution and found that NRMP ROL position moderately correlated with resident performance at graduation; Van Meter et al.19 found weak positive correlation, as did one abstract.27 Bhat et al.8,10,20 Wagner et al.10 and Burkhardt et al.20 did not find a correlation with clinical performance; and two abstracts did not find a correlation between ROL position and ITE performance.27,30

DISCUSSION
Many authors have attempted to quantify the qualities that predict future performance during EM residency. Results for each selection factor are mixed, with no one factor or combination of factors being able to reliably predict a “successful” resident. However, defining a “success” is very difficult. One may feel that a successful resident is one who appears at the top of an unofficial GROL, attaining many measurable and immeasurable qualities that make them intangibly “the best.” While many studies used a GROL or other outcome such as ITE scores, passing the ABEM QE, or having the highest faculty evaluations, all of these outcome measures have inherent flaws. A recent study identified 20 factors (traits, skills, and behaviors) as important in describing a successful EM resident.3

In current EM resident selection, over three-quarters of PDs cite interviews, USMLE scores, SLOEs, and audition electives as important factors in making ranking decisions.1 While the SLOE is rated as one of the most important factors for making interview selection and ranking decisions,1,47,48 it is unclear if it can accurately predict resident success.8,10,12,15,33 These studies probably suffer from selection bias, since each program presumably used the SLOE in their selection decisions; residents were assessed on a program-by-program basis and authors may have been unable to detect a performance difference if there was little variability in SLOE scores. Future studies could leverage the eSLOE49 database to determine performance trends on a national scale. The SLOE has several published benefits, namely, inter-rater reliability and ease and efficiency to review,47,55,56 which are likely responsible for its high utilization.1,53–55

The USMLE is the most frequently studied selection factor in our review. Not surprisingly, the connection between USMLE performance and ITE and ABEM QE performance is stronger than its connection with clinical performance. The NBME cautions against differentiating between applicants using small variations in students’ scores, but does endorse the consideration of USMLE scores in conjunction with other selection factors.57 Currently, there is a national discourse regarding the elimination of numeric USMLE scores to move to a pass/fail system.58 Relying too heavily on any one application item has pitfalls; in isolation, many selection factors do not reliably predict performance. Even when combined for a more global picture, such as NRMP rank list position,
correlation is not reliably demonstrated. Each selection factor may suffer from inconsistency or, worse, bias. Black and Asian medical students are less likely to be inducted into AOA than their white counterparts. Writers of the MSPE may use less positive language for certain racial/ethnic and gender groups. Additionally, the MSPE may be inconsistent in its categories and rankings.

To avoid a reliance on items like the USMLE and AOA, the AAMC created task forces to better assess students’ global performance and noncognitive domains. For example, in an effort to improve the consistency of MSPEs by schools, its guidelines were revised in 2017. Additionally, the AAMC piloted the SVI in EM. The AAMC reports that it does not suffer from bias or correlate with USMLE scores, suggesting that it could provide new information for programs; however, in 2019 AAMC announced that they would discontinue its use in EM for the 2020-2021 application season.

The MMI has been more heavily studied in undergraduate medical education admissions than it has in GME. While the MMI is valuable because it can assess desired constructs during selection, operationally, an MMI may be nonideal for EM. With a high match rate for U.S. seniors applying to EM, many applicants have the luxury of interviewing a program as much as the program is interviewing them. Thus, the MMI may be too one-sided for selection in EM. Other innovative techniques in EM and other specialties include virtual reality–based and simulation-based assessments. Structured, behavioral interviews may measure noncognitive competencies better than traditional interviews. We would not recommend using published interview questions to predict performance; once the applicant pool is familiar with the questions, their predictive value may be diminished.

While the included studies seek to predict a highly successful resident, some may argue that, after years of training and selection, the vast majority of residents are successful. Realistically, many PDs are satisfied graduating capable, competent physicians who do not have professionalism issues. A better question for PDs may be, “Would I choose this resident again?” The time associated with remediating a problematic resident may be more significant than graduating a resident who is “more successful.” Thus, studies that predict unprofessionalism, like those of Bohrer-Clancy et al. and Thaxton et al., may be more relevant to PDs. Several studies, across other specialties, have similarly examined early markers of unprofessionalism. For example, Papadakis and colleagues found that medical students who had concerning, problematic, or extreme unprofessional behavior noted in their medical student file were much more likely to later be disciplined by state medical boards. A study in psychiatry found similar results with negative comments on the dean’s letter/MSPE, being associated with negative actions during residency. We interpret studies like that of Bohrer-Clancy et al. with caution because practices that “flag” a student with a previous leave of absence could discriminate against students with a pregnancy, bereavement, or medical leave.

While avoiding unprofessional and problematic residents is satisfactory, ideally, PDs hope to graduate residents who go on to make a positive impact on the health care system. It is unclear if the constructs that are measured in GME actually predict future health care impactors. For example, a “top resident” who goes on to work in a medically dense community may not have the same impact as an “average” resident who goes on to affect health outcomes in a medically underserved community or by working in an academic medical center. Ideally, future research could aim to marry patient and community outcomes with selection factors, but this would be difficult to study.

**LIMITATIONS**

As discussed, defining “success” is difficult. Furthermore, success during residency may not equate to success as a practicing physician. Many of the included studies have flawed endpoints. There is a nonlinear relationship between resident performance and his or her respective place on a GROL. For some programs and graduation years, there may be very little difference between a top resident and bottom resident; other times, the lowest performing resident may be significantly weaker than the middle or top cohort of residents. Regardless, being a “graduation” ROL, all individuals should be competent to graduate.

Some papers may not have listed all the variables they studied and only reported factors that they found positive. The breadth of papers may suffer from publication bias, with a tendency for negative results to remain unpublished. We tried to minimize this by searching conference abstracts. However, one could argue that conference abstracts could also suffer from publication bias.
CONCLUSIONS

There is mixed evidence for whether selection factors can predict emergency medicine resident performance. The United States Medical Licensing Examination was the most common factor studied. It unreliably predicts clinical performance, but more reliably predicts performance on licensing examinations. All other factors were less commonly studied and, similar to the United States Medical Licensing Examination, yielded mixed results. No single factor has reliably been shown to predict resident performance.

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Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10411/full

Data Supplement S1. Supplemental material.
Tenure Trends in Academic Emergency Medicine Departments in U.S. Medical Schools

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ABSTRACT

Objective: The objective was to assess the long-term trends in tenure status stratified by sex and underrepresented in medicine (URM) status among emergency medicine (EM) department faculty in U.S. medical schools.

Methods: This study used the Association of American Medical Colleges Faculty Roster to study trends in tenure status of full-time faculty from 1989 to 2018. The numbers and proportions of faculty by tenure status were studied over the years and compared across sex and URM minority status. Two-independent-sample t-test and simple linear regression were used for statistical comparisons.

Results: The number of EM faculty increased from 177 in 1989 to 5,237 in 2018, with the majority of increase in nontenured (from 120 to 4,485) rather than tenured (from 24 to 198) or tenure track (from 28 to 548) faculty. The proportions of tenure-line faculty increased briefly from 1989 (29.4%) to 1994 (32.5%) and decreased since to 14.2% in 2018. The decreases were greater among men (from 34.5% to 14.9%) or non-URM (from 32.7% to 14.1%) than women (from 24.8% to 13.1%) or URM (from 30.2% to 15.3%). Compared to other academic departments, EM departments had the second lowest proportion of tenure-line faculty in 2018.

Conclusion: Emergency medicine faculty size increased rapidly in the past 30 years, with the vast majority of growth in nontenured faculty, regardless of sex or URM status. This highlights the need to review career development and academic promotions for EM particularly among nontenured faculty.

The concept of tenure as a category of indefinite academic appointment that can be terminated only for cause or extraordinary circumstances has remained a dominant influence on academic promotion at nearly all medical schools. The Association of American Medical Colleges (AAMC) reported that the majority of medical schools (94%) offer tenure tracks (an employment structure whereby the holder of a post, typically an academic faculty, is guaranteed consideration for eventual tenure) for at least some of their faculty, and the percentage of medical schools with tenure systems has remained fairly consistent over time. In higher education comparatively, 72% of public institutions and 56% of nonprofit (private) institutions have tenure systems in place. However, similar to higher education in general, the proportion of faculty tenured or on a tenure track in medical schools has decreased markedly over the past several decades. The proportion of clinical physician faculty tenured or on a tenure track decreased from 46% in 1984 to 14% in 2013. It was even projected that tenure positions would disappear for new hired physician faculty by about the year 2040. As medical schools and clinical enterprises have expanded over the past several decades, they have increasingly incorporated appointments to nontenured positions,
resulting in a dramatic redistribution of tenure-line and non-tenure-line positions over time.3,4,7,8 It remains unclear how these overall trends in tenure status in academic medicine are applicable to emergency medicine (EM). In a 1997 review of tenure status in EM, it was suggested that EM might be considered “less academic” unless its faculty members gained access to tenure positions.9 Given the decreasing proportion of tenure-line faculty across academic medicine in the nation, we sought to examine the recent trends in tenure status among EM faculty at all Liaison Committee on Medical Education (LCME)-accredited U.S. medical schools. Our desire to study tenure among EM departments was also due in part to the relatively recent recognition of EM as a medical specialty (1979) and EM receiving full board status (1989) by the American Board of Medical Specialties.10 Furthermore, increasing diversity in EM was considered to be a priority in training future EM physicians.11–13 As overall diversity by sex, race, and ethnicity is increasing in academic medicine over the years and since tenure is often viewed as a mechanism to influence this process,14–17 this study also aims to examine the recent trends in diversity and changing tenure status among academic EM department faculty by sex, race, and ethnicity relative to other clinical science department faculty.

METHODS

Study Design
The University of Texas Southwestern Medical Center Institutional Review Board deemed this project exempt from human subject research guidelines as this project involves secondary analysis of existing deidentified data. This cross-sectional study used data from the AAMC faculty roster, a comprehensive national database of faculty in LCME-accredited U.S. medical schools, to examine tenure status of full-time faculty in EM departments. The main outcome measures were the numbers and proportions of faculty by tenure status stratified by faculty sex, race, and ethnicity. These data were obtained through FAMOUS (Faculty Administrative Management Online User System), an online portal for medical schools and researchers to access the faculty roster.18

Methods of Measurement
There were five categories on tenure status in the faculty roster data: tenured, on a tenure track, not on a tenure track, tenure not available, and tenure information missing. In this study, we refer to those faculty who were tenured or on a tenure track as the tenure-line faculty and we refer to those faculty who were not on a tenure track in medical schools with tenure system and faculty in medical schools without tenure system (tenure not available) as nontenured faculty. For completeness of analysis, we also included those faculty with missing tenure status information as one group in the analysis to permit national perspective on all faculty.

We calculated proportions of female and racial and ethnic minorities underrepresented in medicine (URM) by tenure status for faculty in EM departments from 1989 to 2018. We chose to study this period as the American Board of Emergency Medicine gained full board status in September 1989.10 To compare EM faculty tenure status to other clinical departments, we also calculated the proportions of tenure-line (tenured or on a tenure track) faculty among each clinical department for 2018. For the purposes of this study, URM was defined as blacks/African Americans, American Indians/Alaskan Natives, Native Hawaiians/Pacific Islanders, and Hispanics (of any race). The concept of URM minority groups was first addressed by the AAMC in 1970 and was modified in 2004 to describe minority groups that are underrepresented relative to their numbers in the general population.19

Primary Data Analysis
The two-independent-sample t-test was used to investigate significant differences in sex, race, and ethnicity among EM faculty by tenure status. To assess tenure trends by faculty sex, race, and ethnicity from 1989 to 2018, the slope and the associated p-values for each group were estimated by using a simple linear regression model, in which year was used as an independent variable. All p-values were two-sided; p < 0.05 was considered statistically significant. Statistical analyses were conducted with SAS version 9.4.

RESULTS
The past three decades saw significant growth in academic EM faculty size. Full-time faculty in EM departments grew nearly 30-fold from 177 in 1989 to 5,237 in 2018. While more men than women are in this field overall, the proportion of females increased over the years during the study period. While the total
number of faculty increased among each racial and ethnic group and among both men and women, the proportions of white faculty among both men and women decreased and the proportions of Asian and URM faculty increased. On average, the number of non-URM males increased by 106 per year and non-URM females increased by 56 per year, whereas URM males increased by 10 per year and URM females increased by 8 per year (Figure 1A). While the proportions of non-URM males were decreasing and non-URM females were increasing over the years, the proportions of URM males were largely stagnant (trendline $p = 0.616$) and the proportions of URM females remained rather flat (moving from 0% in 1989 to 4.5% in 2018; Figure 1B).

While the number of faculty increased in all tenure status during the study period, the proportion of tenure-line faculty (those tenured or on a tenure track combined) decreased (Figure 2A). However, the proportions of tenure-line faculty increased initially for female and URM faculty from 1989 to 1994. Since 1994, their proportions decreased (Figure 2B). Furthermore, the difference in proportions of tenure-line faculty among subgroups has been shrinking over the years. Data about tenure status were missing for about 3.9% (2,621 of 66,442 person-years) of faculty over the years.

Converse to this trend, the number of nontenured faculty grew more than 37 times from 120 (or 67.8% [120 of 177]) in 1989 to 4,485 (or 85.6% [4,485 of 5,237]) in 2018. Although nontenured faculty were more common among women than men, the increase of nontenured faculty was greater among men than women faculty (Figure 3A). Among URM faculty, the vast majority remained nontenured. While the proportions of nontenured faculty rose in almost all groups by sex and URM status, the absolute differences shrank over the years (Figure 3B). Men remained the majority of nontenured faculty in all racial ethnic groups except black faculty. Women represented 54.2% (103 of 190) of nontenured black faculty in 2018 (data not presented).

Interdepartment comparisons show significant variations in the proportions of tenure-line faculty. While the national average of tenure-line faculty was 22.1% (34,481 of 155,677) for clinical science departments in 2018, female faculty had lower proportions on tenure-line than male faculty across all departments overall. Similarly, URM faculty generally had lower proportions on tenure-line than non-URM faculty. Overall, EM claimed the second lowest proportion (14.2% [746 of 5,237]) of tenure-line faculty among all clinical science departments, slightly higher than that in family medicine (12.9% [734 of 5,708]) but lower than that in anesthesiology (15.1% [1,342 of 8,881]), obstetrics-gynecology (17.6% [1,119 of 6,357]), and pediatrics (19% [4,423 of 23,258]). However, there are interdepartmental nuances in proportions of male versus female tenure-line faculty (Figure 4A) as well as URM vs non-URM tenure-line faculty (Figure 4B). The differences between men and women as well as URM and non-URM were absent in 2018 for EM departments and departments of physical medicine and rehabilitation.

**DISCUSSION**

This study found that while the number of faculty tenured or on a tenure track increased in EM departments, their proportion decreased due to substantial rise in the number of nontenured faculty. The decline of tenure-line faculty and the concurrent rise of nontenured faculty in academic EM appear to mirror the overall tenure patterns in academic medicine. Redefining and limiting the tenure guarantee is an important element of academic medical center efforts to restructure compensation plans for their faculty. Medical schools have continued to revise their policies and faculty compensation structures for both clinical and basic science department faculty and increasingly provide no financial guarantee associated with tenure or, when they do, it is on a much more limited basis. This could also have some repercussions on faculty recruitment and retention. For example, because talent loss is so severe in URM faculty, some argue that tenure could be used as a tool for faculty retention. However, as the proportion of tenure-line positions significantly decreased over the years, tenure status may be losing its value as a viable avenue for increasing faculty diversity and retention in academic EM. It also suggests that the decline of tenure may necessitate additional interventions to increase faculty diversity by sex, race, and ethnicity.

This study also found that despite increases in sex and racial/ethnic diversity among faculty, diversity in EM remains poorly reflective of the general population and patients. Potential interventions include initiating programs to expose female and URM medical students to EM during their preclinical years, providing meaningful exposure to the field of EM in their third
Figure 1. Numbers of EM faculty, according to combined sex and URM status, 1989–2018 (A); percentages of EM faculty, according to combined sex and URM status, 1989–2018 (B). URM = underrepresented in medicine. Data sources: Association of American Medical Colleges Faculty Roster, December 31 snapshots.
Figure 2. Numbers of tenure-line EM faculty, according to combined sex and URM status, 1989–2018 (A); percentages of tenure-line EM faculty, according to combined sex and URM status, 1989–2018 (B). URM = underrepresented in medicine. Data sources: Association of American Medical Colleges Faculty Roster, December 31 snapshots.
Figure 3. Numbers of nontenured EM faculty, according to combined sex and URM status, 1989–2018 (A); percentage of nontenured EM faculty, according to combined sex and URM status, 1989–2018 (B). URM = underrepresented in medicine. Data sources: Association of American Medical Colleges Faculty Roster, December 31 snapshots.
Figure 4. Percentages of tenure-line faculty in clinical science departments, according to sex, 2018 (A); percentages of tenure-line faculty in clinical science departments, according to URM status, 2018 (B). Error bars represent 95% CIs. URM = underrepresented in medicine. Data sources: Association of American Medical Colleges Faculty Roster, December 31 snapshots.
and fourth years, enhancing the diversity among EM residents and fellows, providing mentorship for female and URM faculty. The Accreditation Council for Graduate Medical Education recently revised all residency programs requirements, including those for EM, to include an explicit recommendation to consider workforce diversity as a core element when conducting residency program evaluations. The Society for Academic Emergency Medicine and the American College of Emergency Physicians incorporated diversity and inclusion as part of their mission and strategic plan and designated specific approaches to increase the diversity of the emergency physician workforce. This is important for academic EM as the pressure is forming to create a third wave of health professions education reform to hold programs accountable to their communities. While a diverse physician workforce is considered to be important for mitigating health care disparities, future studies should continue to assess the value of diversity in EM.

This study also found that, while the diversity by sex, race, and ethnicity increased among academic EM, the increase was mostly among nontenured faculty. The rise of nontenured faculty in higher education have raised concerns about the effect on educational quality, impact on academic freedom, and career satisfaction of the non–tenure-track faculty members. The American Association of University Professors long believed that the increase in non–tenure-track faculty appointments can lead to a decline in educational quality because it is more difficult for non–tenure-track faculty fully engage in their academic disciplines and with their students because they usually receive fewer resources than do those on a tenure track. Moreover, early studies have found that tenure-line faculty had a higher promotion rate, lower attrition rate, and higher retention rate than nontenured faculty in U.S. medical schools. Whether this pattern is applicable to academic EM department faculty is a worthy question to be examined in the future.

Whether the concerns in higher education about the increase of non–tenure-track faculty over the years also apply to academic EM to fulfill its academic missions successfully is another worthy question to explore in the future. This study found that, despite the prevalence of tenure systems in U.S. medical schools overall, the proportions of tenure-line EM faculty decreased over the past three decades. The increase of nontenured faculty in academic EM may be reflective of the challenges in coordinating the tripartite mission areas of education, research, and clinical care in academic medicine. As academic medicine is facing many challenges—such as the need to make medical education more interprofessionally focused, the pressure to increase clinical revenues due to the changing health care environment, and the fierce competition for research dollars, it is relying more and more on nontenured faculty who are primarily focused on seeing patients and teaching a little. Some blamed the shifting balance of the three major missions of academic medicine for the creation of a suboptimal health system in the United States.

Tenured positions may also be less attractive for clinician faculty because they often require active research and grant seeking generally without additional salary support during a time when clinical productivity is emphasized and measured. The shifting from tenure-line positions to nontenured positions in academic medicine is likely related to the fierce pressure among most clinical departments within medical schools to generate clinical revenue. The shift in tenure landscape in medical schools is accompanied by a growing number of medical schools with intensified focus and priority of protecting and growing the clinical enterprise that is shifting the center of gravity and the locus of power away from the academic institution and toward the clinical enterprise. These challenges are forcing academic medicine to increasingly rely on clinical revenues as federal and state supports are dwindling, which may further exacerbate this trend toward largely nontenured faculty in academic medicine. AAMC data show that the share of medical service for revenues of U.S. medical schools increased from 38.6% in 1989 to 62.3% in 2018.

LIMITATIONS

There are several limitations in this study. First, the standards and criteria for achieving tenure may vary from one medical school to another school. However, tenure as a concept has a long history and is well understood in U.S. higher education. Second, faculty roster data were reported by medical schools. We therefore could not confirm if faculty sex, race, and ethnicity were completely self-reported. Previous studies demonstrated inaccuracies to document race/ethnicity in electronic health records. Third, we used cross-sectional data reported on December 31 of each calendar year and not an average or reflection of data...
trends over the whole year. Data pulling on different date may result in small differences due to the fact that data is updated nearly on a daily basis. Third, we reported tenure status by department classification, not by physician’s specialties. For instance, there could be a physician faculty member who specialized in family medicine serving in an EM department. Moreover, not all faculty are necessarily physicians. In 2018, 93.5% of full-time faculty in EM departments were physicians. Different strategies may be needed to improve the diversity of nonphysician faculty. Additionally, there were some missing data for certain faculty. However, the proportions of missing data for tenure status as well as for race and ethnicity were relatively small compared to faculty with complete data. Furthermore, as EM was recognized as a medical specialty in 1979 and gained full board status in 1989, not all divisions of EM in all medical schools attained full department status. However, due to our limitations in data access, we were unable to examine faculty in divisions of EM. Finally, due to use of deidentified data, we were unable to link faculty tenure status to factors that might influence the attainment of tenure such as their grant acquisition and research publications.

CONCLUSION

In conclusion, while both the numbers of tenure-line and nontenured faculty increased among emergency faculty over the past 30 years, the proportion of tenure-line faculty decreased and the proportion of nontenured faculty increased. Although the gaps among sex and racial ethnic groups were shrinking for tenure status in academic emergency medicine, females and minorities underrepresented in medicine have lower proportions tenured or on a tenure track.

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Clinical Integration of Point-of-care Ultrasound by Emergency Medicine Residents: A Single-center Mixed-methods Study

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ABSTRACT

Background: Point-of-care ultrasound (POCUS) competence consists of image acquisition, image interpretation, and clinical integration. Limited data exist on POCUS usage patterns and clinical integration by emergency medicine (EM) residents. We sought to determine actual POCUS usage and clinical integration patterns by EM residents and to explore residents’ perspectives on POCUS clinical integration.

Methods: We conducted an explanatory sequential mixed-methods study at a 4-year EM residency program. In phase 1, EM ultrasound (US) attendings observed PGY-4 EM residents’ clinical integration of POCUS in real time while on shift in the emergency department (ED). EM US attendings evaluated residents on their intent to perform POCUS, actual POCUS usage, and competence per patient encounter. We used logistic regression to analyze these parameters. In phase 2, we conducted semi-structured interviews with the observed PGY-4 residents regarding POCUS usage and clinical integration in the ED. We analyzed qualitative data for themes.

Results: Emergency medicine US attendings observed 10 PGY-4 EM residents during 254 high-acuity patient encounters from December 2018 to March 2019. EM US attendings considered POCUS indicated for 26% (66/254) of patients, possibly indicated for 12% (30/254) and not indicated for 62% (158/254). Of the 66 patients for whom EM US attendings considered POCUS indicated, PGY-4s intended to perform POCUS for patient management 61% (40/66) of the time. PGY-4s subsequently incorporated POCUS into patient management 73% (48/66) of the time. EM US attendings considered PGY-4s entrustable to perform POCUS independently 81% (206/254) of the time. We did not find a statistically significant association between shift volume, shift type, or POCUS application, and resident intent to perform POCUS or competence. Interviews identified three factors that influence PGY-4’s POCUS clinical integration: motivations to use POCUS, barriers to utilization, and POCUS educational methods.

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Conclusions: This mixed-methods study identified a significant gap in POCUS utilization and clinical integration by PGY-4 EM residents for clinically indicated cases identified by EM US attendings. As clinical integration is a cornerstone of POCUS competence, it is important to ensure that EM resident POCUS curricula emphasize training on clinical utilization and indications for POCUS while on shift in the ED.

Since 2001, the Accreditation Council for Graduate Medical Education has recommended that graduating emergency medicine (EM) residents demonstrate competence in point-of-care ultrasound (POCUS). Since then, the Society for Academic Emergency Medicine (SAEM), the American College of Emergency Physicians (ACEP), and the Council of Emergency Medicine Residency Directors (CORD) have emphasized the importance of requiring POCUS competence for EM residents. The Society of Clinical Ultrasound Fellowships (SCUF) defines POCUS competence as “clustered skills of medical knowledge and technical aptitude to employ clinical ultrasound for optimized patient care and clinical outcomes.” Most POCUS experts agree that POCUS competence consists of three distinct domains: image acquisition, image interpretation, and clinical integration. Accurate clinical integration builds on image acquisition and interpretation skills. Clinical integration includes both understanding when (and when not) to perform POCUS and how to integrate the findings into medical decision making. While SAEM, ACEP, and CORD have published recommendations for EM resident POCUS education and competency assessment, actual POCUS educational practices in the United States still vary widely.

Literature regarding best practices for education and assessment of resident image acquisition and image interpretation is well developed. Image acquisition and interpretation skills can be efficiently and accurately taught and assessed through asynchronous lectures, task simulators, scan shifts, case log review, multiple-choice exams, image review, structured clinical exams (OSCEs), and direct observational tools (SDOTs). However, there is a dearth of literature describing best practices for education and assessment of resident clinical integration skills. The PC12 subcompetency in the EM Milestones document suggests that a graduating resident should “consistently utilize and integrate appropriate ultrasound applications into clinical management.” SAEM, ACEP, and CORD recommend longitudinal POCUS education during EM residency. These recommendations serve as a general benchmark but are difficult to implement as there is no specific nor standardized approach.

Competency-based medical education suggests that trainees will develop image acquisition, image interpretation, and clinical integration competence at different rates throughout training and practice. Attaining expertise in one domain does not predict expertise in another domain. Furthermore, competence in image acquisition and interpretation is a necessary building block to develop accurate clinical integration. Thus, a complete POCUS competency assessment should ideally be multifaceted and should collect data on resident image acquisition, image interpretation, and clinical integration skills. The tools currently suggested for assessment of clinical integration skills, SDOTs and OSCEs, lack important real-life variability that complicates actual POCUS usage and integration. To our knowledge, no research has been performed regarding in situ observation of EM residents’ POCUS utilization and clinical integration. In this study, we sought: 1) to assess PGY4 EM resident competence to use POCUS to diagnose and manage patients while on shift in the emergency department (ED) and 2) to explore resident perceptions on POCUS usage and clinical integration in the ED.

METHODS

Study Design
We conducted an explanatory sequential mixed-methods study at an academic PGY1–4 EM residency program. We believed that a mixed-methods approach would add depth to our conclusions and minimize the inherent limitations of using either quantitative or qualitative methods alone. A mixed-methods design achieves this by broadening and triangulating findings discovered from both components. This is particularly important when studying a new topic in a complex and natural environment, as we did. An explanatory sequential design involves a two-phase methodology. Quantitative data are initially collected and analyzed. Quantitative results then inform purposeful selection of participants for the qualitative phase, which is used to shed light on the quantitative
results. An explanatory sequential design was ideal for our project. We primarily gathered observational data regarding resident POCUS usage and then explored their opinions in order to understand the patterns of usage discovered in the quantitative strand. As such, our study was conducted in two phases: 1) real-time observation of EM residents’ use of POCUS while working in the ED and 2) qualitative assessment of these residents’ perspectives on POCUS utilization and integration.

Study Setting

Our EM residency is a PGY1–4 academic program. Residency class size varies from 13 to 15 residents per year. Our ED sees an annual volume of 113,000 patients. Our hospital trains one to three EM ultrasound (US) fellows per year who work clinically as attendings in the ED. We conducted the study in the acute area of our ED. Triage to Acute, the highest-acuity area, is determined by the EM triage nurse. The majority of patients triaged to Acute are Emergency Severity Index (ESI) level 1 to 3 with a high proportion being ESI level 1 and 2. There are three 8-hour Acute EM attending shifts per day. During each shift, the PGY-4 and EM attending work jointly to evaluate and manage all patients and supervise junior providers (EM residents, EM physician assistants, and non-EM rotating residents).

The US curriculum at our institution is currently multifaceted; however, at the time of this study, the PGY-1 US rotation was the core of our POCUS curriculum. Residents have no clinical responsibilities during this 4-week rotation. They attend twice-weekly US conference with didactics and scan review. Residents additionally spend approximately 18 hours per week scanning patients in the ED with direct bedside supervision by an US faculty member or fellow. As PGY-3s, residents complete an OSCE designed to assess their ability to acquire images, interpret images, and incorporate them clinically in all US applications. Any deficiencies are noted and retested in the PGY-4 year. EM US faculty or fellows deliver US-themed didactics approximately six times per year at EM resident conference. Residents are required to complete at least 300 scans by the end of residency.

Inclusion and Recruitment

All PGY-4 residents who worked in the acute area of our ED during the study period were eligible for inclusion in the study. Prior to the study period, we notified residents via e-mail that US faculty and fellows would be observing their usage of POCUS while on shift in the ED.

Quantitative Study

We investigated the following using a questionnaire:

- Indications for POCUS as determined by EM US attendings;
- Patterns of POCUS usage and clinical integration by PGY-4 EM residents during clinical shifts;
- Competence of PGY-4 residents using POCUS to diagnose and manage critically ill patients.

Survey Development. To assess these objectives, we developed a survey instrument (see Data Supplement S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10463/full). We revised this survey after discussions with US faculty and medical education experts to ensure content validity. Four EM US attendings and two research associates (RAs) piloted the survey in the ED for 2 weeks prior to the study period. All four EM US attendings and the two RAs met to analyze and discuss pilot survey response inconsistencies. We then revised the survey to agree upon content and format. It was specified that for POCUS to be “indicated,” the performance needed to be a critical diagnostic or management action for the patient. We included a three-point behaviorally anchored global competence assessment in the survey. This was based on the International Federation for Emergency Medicine (IFEM) framework for POCUS assessment. We adapted this framework to specify competence in critically ill patients. We used the terminology entrustable, pre-entrustable, and not entrustable with a priori agreed-upon definitions. We agreed that a resident’s competence would be assessed per patient encounter. As POCUS competence naturally builds from basic knowledge to image acquisition and interpretation then clinical integration, we were not able to separate clinical integration competence from the other domains. As per the 2016 revised POCUS milestones, we specified that for a resident to be entrustable they should “consistently utilize and integrate appropriate ultrasound applications into clinical management” without assistance. We intended the survey development process and the data collection process detailed below to strengthen validity by providing content and response process evidence.
Data Collection and Analysis. Four EM US attendings performed observations while working clinical shifts in the acute area of the ED from December 2018 to March 2019. Two attendings were US faculty members, both of whom completed emergency US fellowships and have at least 10 years of clinical experience in EM. Two were fellows; one was a second-year EM US fellow and the other was a first-year EM US fellow.

The two RAs who were present during the survey discussions administered the survey to the faculty and fellows while on shift in an effort to maintain response consistency. RAs were typically present in the ED for other research studies and worked closely with attendings, so their presence was not unusual. We collected data on each patient who presented to the acute area of the ED during each shift. As per usual, the PGY-4 presented each patient to the EM US attending, including their diagnostic, treatment, and management plan. The EM US attending then separately evaluated the patient. The RA then asked the EM US attending if POCUS was indicated, possibly indicated, or not indicated. For each case, the RA asked the attending if the PGY-4 had planned to perform POCUS (presented it as part of their initial plan), planned to perform POCUS only after prompting, or had no plan to perform POCUS for the patient’s diagnosis or management. All EM US attendings agreed a priori that if the resident did not mention POCUS in the initial plan, and it was indicated, they would prompt by saying “What about ultrasound?” The RA additionally tracked whether or not the POCUS was performed and by whom. As is natural for patients requiring active resuscitation, the EM US attending and the resident evaluated the patient simultaneously. It is typical in our residency for the PGY-4 resident to guide the resuscitation and the attending to observe unless it is critical to intervene. During these cases, if the PGY-4 resident did not use POCUS during the resuscitation, nor guide a junior provider to use POCUS, the EM US attending assumed that the PGY-4 did not intend to use POCUS. We determined a priori that we would debrief post-resuscitation with the resident to confirm these assumptions and clarify intent.

We collected and managed study data using the REDCap electronic data capture tool hosted at Partners Health System (www.projectredcap.org). We exported data to Microsoft Excel Version 16.23 (2019) and Stata MP 15.1 (StataCorp 2017). We report descriptive statistics as ratios and percentages. We analyzed quantitative data using logistic regression for the dependent variables POCUS indication, resident intent to perform POCUS, and competence, controlling for shift volume, shift time, and attending. We used chi-square analysis to determine if there was a statistically significant difference between the frequency of each attending’s assessments for each dependent variable. We intended the chi-square analysis to augment internal structure validity for our construct. Individual resident performance was controlled using random slopes for each resident.

Qualitative Study
We conducted a qualitative arm to add depth to the analysis and to attempt to explain patterns discovered during quantitative analysis. We followed a
pragmatic worldview, wherein individual researchers have the freedom of choice to use all research approaches available in order to provide the best understanding of the research problem at hand.\textsuperscript{20} We used a generic qualitative approach as our study design did not fit specific qualitative methodologies.\textsuperscript{20} We invited all residents to interview. We scheduled six residents for interviews who were felt to be an equal representation of the cohort of 10 residents including all possible demographics and viewpoints.

**Data Collection.** An US fellow with training in qualitative methods conducted six semi-structured approximately 20-minute interviews with the PGY-4s. The US fellow had worked clinically with the PGY-4s for 2 years at the time of the interviews. We started the interview with open-ended questions about the PGY-4’s relationship with POCUS during shift and then adapted the interview accordingly to explore the results discovered in the quantitative arm. The interviews were recorded using an encrypted iPhone XS and its proprietary voice memo application (Apple Inc., 2019). After recording, the US fellow deidentified the interviews and transcribed them using the transcription software TranscribeMe! (TranscribeMe Inc., Version 3.1.1). The US fellow reviewed the transcripts for accuracy.

**Data Analysis.** Two EM US fellows, one of whom conducted the interviews, reviewed the transcripts in depth to identify segments of data that pertained to specific concepts or topics (codes). Both fellows performed all steps of qualitative data analysis. They performed open coding first to obtain as many codes as possible that aligned with the study questions. After completing open coding, the investigators attempted to group codes into coding categories. Repeating categories formed the basis of thematic analysis and key themes were identified. We performed data collection and analysis concurrently to inform future data collection. We modified interview questions for clarification or further exploration of opinions. To maximize confirmability, we met three times to review themes and reflect on limiting bias. The entire US research group additionally met to perform peer debriefing on themes. As there is no literature on this subject, we were not able to find evidence that confirmed or disconfirmed our findings. We performed member checking via e-mail to ensure that themes identified by the investigators accurately reflected participant narratives. We e-mailed the qualitative results to all six residents who were interviewed. We asked them to review and report back as to whether or not the data accurately reflected their opinions. We received feedback from four of six residents that the narrative included an accurate reflection of their views. We did not hear back from the rest (2/6).

The interviewer was not in a position of power over participating residents because the interviews were conducted in the final few weeks of the final month of residency and fellowship. At that point, the fellow had no further evaluation nor supervisory role with the residents. The interviewer ensured confidentiality, used open-ended questions to allow for a variety of opinions including those that contradicted the majority opinion, and explored data to identify themes that were unexpected or contradicted the norm. The study was deemed exempt by the institutional review board.

**RESULTS**

**Quantitative**

Emergency medicine US attendings observed 10 PGY-4 EM residents from December 2018 to March 2019. These observations occurred during the 15 consecutively scheduled shifts for the four EM US attendings in the acute area. There were 254 patient encounters during the study period. Shift volume ranged from eight to 28 patients per 8-hour shift.

**Indications for POCUS.** Point-of-care US was considered indicated by the EM attending for 26% of patients. Figure 1 highlights application type selected for the clinically indicated cases. (Multiple applications could be selected as indicated for each patient encounter.)

**Resident Intent to Use POCUS.** When POCUS was indicated, residents mentioned POCUS in their plan without prompting 61% of the time (Table 1).

**Assessment of Competence.** The PGY-4 was considered entrustable to use POCUS to diagnose and manage critically ill patients in the ED in 81% of patient encounters (Table 1).

**Resident Use and Incorporation of POCUS.** When POCUS was indicated, POCUS was actually performed 89% of the time (by PGY-4 or other provider) and subsequently incorporated into
PGY-4’s patient management 74% of the time (Table 1). We determined “incorporation into practice” by asking if the resident used POCUS findings to explicitly change or confirm management or disposition decisions, which we ascertained from the case discussion with the PGY-4.

**Regression Analysis.**

**POCUS Indication** Chi-square analysis did not detect a difference between individual attending assessment of indication (Table 1). We did not detect an association between attending assessment of indication and shift volume. Attendings were less likely to say POCUS was indicated than not indicated for the 3 PM to 11 PM shift versus the 7 AM–3 PM shift (odds ratio [OR] = 0.40, 95% confidence interval [CI] = 0.17 to 0.97, p < 0.05).

**Resident Intent to Use POCUS** There was a difference detected between individual attending assessment of resident intent to use POCUS ($\chi^2 = 7.8292$, p = 0.05; Table 1). However, when using logistic regression to control for resident, shift volume, and shift time, this difference was not detected. The only exception was that attending 4’s assessment of POCUS indication aligned with the residents’ assessment of indication significantly more than attending 1 (OR = 0.11, 95% CI = 0.013 to 0.96, p < 0.05). We did not find a statistically significant association between shift volume, shift type, or application indicated, and resident intent to use POCUS.

**Competence** There was a difference detected among attending assessment of competence ($\chi^2 = 39$, p < 0.01; Table 1). However, when using logistic regression to control for resident, shift volume, and shift type this difference was not detected. We did not find a statistically significant association between competence and shift volume, shift type, attending, or application indicated.

**Qualitative** We conducted six resident interviews during May 2019. Three PGY-4s were female and three were male. Upon graduation, three entered community practice and three entered academic fellowships (one of these...
was an US fellowship). We felt that this was representative of the cohort of the 10 residents who were observed, because four of 10 (40%) went into community practice. Three residents were above the median for considering POCUS without prompting and three were below the median.

Based on analysis of interview transcripts, we grouped factors that influence POCUS clinical integration by PGY-4s under the following three categories:

1. Motivations to use POCUS;
2. Barriers to utilization;
3. How they learn clinical integration of POCUS

Under each category, we describe key themes and define the themes backed by representative quotes from PGY-4s.

**Motivations to Use POCUS.** Under this category, we include themes that relate to perceived indications for residents’ use of POCUS during Acute ED shifts.

*Immediately Rule In or Out diagnosis* Participants stated that POCUS helped with time management because of its ability to rapidly rule in or out diagnoses at the bedside.

I don’t have the luxury of going back in the room or revisiting the [patients’] data ... when I’m managing 25 sick patients ... it [US] has become part of my pattern recognition.

*For Sick Patients With Specific Chief Complaints* Residents emphasize that POCUS is most powerful as a diagnostic tool when the patient is “sick” (abnormal vital signs and/or clinically appearing unwell). They additionally emphasize that they most frequently use POCUS for sick patients with cardiopulmonary chief complaints and/or undifferentiated hypotension.

Anytime that EMS brings [a patient] in on BIPAP I get the US in the room. I find the difference between diuretics/nitro and albuterol in someone who is already panicking is pretty important.

*Risk Stratify Patients to Guide Further Treatment/Management* Residents explain that POCUS can be useful for patients who do not have a clear diagnosis from initial history and physical examination. They use POCUS to risk stratify these patients to guide imaging, medication, or disposition decisions.

The diagnosis was kind of up in the air and we ended up sending the patient, intubated, to the CT scanner where they decompensated. Maybe, if I’d seen that big dilated right ventricle, I would’ve thought twice about intubating that person.

One resident notably stood out from the rest when they remarked they use US “All the time. US is benign. There is no downside to looking. Never have I found an US worked against me.”

**Barriers to POCUS Utilization.** Under this category, we include themes that relate to perceived barriers to residents’ use of POCUS during acute ED shifts.

*Lack of Evidence for Clinical Utility* PGY-4s emphasize only using POCUS when there is literature to support its utility. They specifically mention the lower predictive value of POCUS for patients who clinically appear well with stable vitals and the lack of evidence supporting POCUS usage in stable patients with abdominal trauma, and for volume status assessment.

I try not to FAST young stable people because that is a misapplication of the research and we shouldn’t do it and I think we actually (CT) scan too many young people as a result.

*Perception That POCUS Would Slow Down Other Processes* PGY-4s mention needing to appropriately allocate resources, especially time, when patient volume is high and that doing POCUS often takes time away from other important tasks.

... it’s a trade-off. US ... would take time, may not ... change what I want to do ... I already know I’m going to admit this patient ... [US] would slow down ... other ... processes ... like reviewing ... with the juniors or making sure that people get beds earlier or finishing notes.

*Lack of Confidence in Clinical Integration Skills* PGY-4s mention that they do not use POCUS due to a lack of confidence in their own clinical
integration skills. In fact, most are still unsure if they are over or underutilizing POCUS and express a desire to hone this skill.

I have to ask myself, “am I using it too much and perhaps not in the right context?” And then will I be identifying things I was never looking for that might lead me own a diagnostic pathway that was sort of completely erroneous?

**How PGY-4s Learn Clinical Integration.** Under this category, we include themes that relate to perceived factors that contribute to how PGY-4s learn POCUS clinical integration skills.

*“On-the-job” Development of Personal Practice Preferences* Participants explain that they develop their US practice style through personal struggles with time and resource management, and self-reflection while on shift.

No one ever taught me. I was doing a lot of unnecessary ultrasounds to begin with for fun, and I kept being like “What is it changing? ... If it’s not going to change my clinical management then I should not be wasting my time on something useless and try to be more efficient with what I spend my time on.

**Formal Teaching Focuses on Image Acquisition and Interpretation Rather Than Clinical Integration** Residents mention that time during the intern US rotation is spent learning image acquisition and interpretation skills rather than clinical integration skills, which they mention are distinctly different skills.

When we do our US rotation, we go around and we US ... people that are separate from clinical care, and so I think the crux is really integrating it. It’s one thing to learn how to do the scans ... but then to try to integrate ... I think is the hard thing.

**Learn by Example from US Attendings, Not Through Explicit Discussion** Residents note that they mostly learn POCUS clinical integration from watching US attendings incorporate US into their patient workup and management. Residents note that there is not an explicit discussion of POCUS test characteristics nor indications for use.

It’s a real cultural difference ... when you have [an attending] who not only is encouraging residents to do ultrasound but is confident in interpreting the results ... You can be in a dry spell ... working with faculty who aren’t as facile with US who aren’t prompting you ..., and then you get an attending who ... [is] prompting you ... Then that kind of clicks in our brain.

The minority mention that some younger faculty and critical care faculty additionally model clinical integration of POCUS. In addition, two residents mention their own self-study outside of shift guiding their clinical integration education.

**DISCUSSION**

To our knowledge, our study is the first to publish actual data regarding EM resident POCUS usage and clinical integration while on shift. In a survey of 539 EM residency graduates from 18 different residency programs, residents expressed that the only reliable method of POCUS competency assessment was through in situ observation and that other methods (case log review, quality assurance, SDOTs, OSCEs) were all “poorly representative” of their skills. Clinical reasoning experts additionally emphasize the importance of real-time workplace-based assessment of trainees as the workplace is the “core of medical competence.”

At our institution, all residents are considered competent to perform POCUS by the end of their PGY-3 contingent on successful completion of at least 300 expert-reviewed scans and passing an US OSCE. All of the observed PGY-4s in our study met these criteria. While clinical integration is naturally addressed during POCUS education, there is no deliberate curriculum for clinical integration at our institution. Formal assessment of clinical integration is not currently part of our resident POCUS evaluation. Therefore, little has been known about actual POCUS clinical integration by residents, their accuracy of clinical integration, nor the efficacy of our current curriculum.

After observing our residents, we identified an important gap between when EM US attendings and PGY-4 residents consider POCUS indicated. We additionally observed that PGY-4s performed POCUS and
integrated it into clinical management less often than we thought was indicated. PGY-4s mentioned POCUS in their initial plan 61% of the time when POCUS was deemed indicated by EM US attendings. Our on-shift observations demonstrated that PGY-4s were competent to perform POCUS independently (in critically ill patients) only 81% of the time. These findings have encouraged us to reconsider our POCUS curriculum and to be more deliberate about teaching and assessing POCUS clinical integration to our residents.

While we can make no conclusions about other residency programs, we hope that this information may also inspire other POCUS educators to deliberately consider their clinical integration curriculum. This deliberate consideration is especially important in light of the fact that we still lack best practice guidelines for POCUS clinical integration curriculum and assessment.\textsuperscript{2} One Canadian residency program has developed a POCUS curriculum rooted in the theory of deliberate practice, including reflection and feedback during clinical shifts.\textsuperscript{25} Their published data only reports image acquisition and interpretation skills, not on-shift clinical integration skills. Given the importance of in situ observation for competency assessment,\textsuperscript{3,24} we hope that our findings further inspire the development of a deliberate practice clinical integration curriculum in the United States and a rigorous on-shift competency assessment tool for clinical integration skills.

As learners’ perspectives are critical for developing effective instructional design, we attempted to explore what guides PGY-4s’ current understanding of POCUS clinical integration through our qualitative phase.\textsuperscript{26} Our study is the first qualitative description of EM residents’ perceptions on POCUS usage and clinical integration. We identified key factors that contribute to PGY-4 EM resident POCUS clinical usage and the manner in which PGY-4s learn how to clinically integrate POCUS at our program. Our qualitative data helps us to understand what guides residents’ POCUS clinical utilization and integration so that we can more effectively facilitate the development and elaboration of frameworks that are more attuned to reality.\textsuperscript{18} While our findings may not be generalizable to other programs, we believe that this information may resonate with other POCUS educators and hope that it will encourage deliberate consideration of residents’ perspectives.

Finally, our study is the first to identify actual on-shift indications and practice patterns for POCUS usage by a small group of EM US experts. This is important information that will be incorporated into our future clinical integration curriculum. Furthermore, it could be of interest to other POCUS educators or clinicians who use POCUS to diagnose and manage critically ill patients to learn of the actual practice patterns of our small group of POCUS enthusiasts.

**LIMITATIONS**

This study has many limitations. Our findings are most applicable to our residency program. Generalizability may be limited to only 4-year academic programs with an US fellowship. Aside from its single-center nature and limited generalizability, on-shift assessment has inherent limitations and is subject to many biases and questionable reliability.\textsuperscript{3,17} Given that attendings were documenting their interpretation of resident intent to perform POCUS, we do not know the residents’ actual thoughts. We believed that asking residents their opinions would have resulted in significant bias via the Hawthorne effect and would not have been feasible given the significant time and resource demands while on shift.

It is noted that only EM US attendings determined whether POCUS was clinically indicated and not all EM attendings. We felt that only EM US faculty members and fellows reliably possessed the requisite knowledge and experience to assess POCUS clinical integration skills. We acknowledge that there may be a bias toward a perception that US is indicated as EM US faculty are likely to incorporate US into clinical decision making more often than EM faculty without specific US training. We attempted to strengthen validity through methods mentioned, but did not perform a traditional inter-rater reliability for internal structure. We felt that it would not be feasible to review all 254 charts to calculate a kappa for inter-rater reliability, especially as this would lack the important real-life variables of shift volume and patient flow that often impact the decision to perform POCUS or not. We attempted to maximize response process and internal structure through the use of RAs. We understand that most programs do not have access to RAs, which further limits generalizability and reproducibility of our conclusions. We additionally did not assess consequences of our testing nor provide a significant amount of evidence in the form of relation to other variables.\textsuperscript{23}

While we attempted to maximize methodologic rigor in the qualitative arm, we did not interview all residents and therefore may have missed other opinions.
Finally, interviews were performed by one of the EM US fellows, instead of an independent third party, which could have led to bias in the interview responses.

CONCLUSIONS
In this mixed-methods evaluation of residents’ perceptions and actual point-of-care ultrasound performance while on shift, we identified a significant utilization and integration gap by our PGY-4 emergency medicine residents for clinically indicated cases identified by emergency medicine ultrasound attendings. We believe this study helps to further our understanding of how to teach the critical skill of point-of-care ultrasound clinical integration and how to assess emergency medicine residents’ point-of-care ultrasound competence. We believe that this study highlights the importance of deliberate and proper training in point-of-care ultrasound clinical integration. We additionally provide important and novel perspectives from emergency medicine residents regarding point-of-care ultrasound clinical utilization and integration.

This information will be used to guide curricular improvement locally at our institution. We hope that it inspires other point-of-care ultrasound educators to assess their residents in situ in the ED and to deliberately consider their clinical integration educational and assessment methods.

References


Supporting Information
The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10463/full
Data Supplement S1. Attending survey.
Applications of Postresuscitation Debriefing Frameworks in Emergency Settings: A Systematic Review

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ABSTRACT

Objectives: Postresuscitation debriefing (PRD) is a valuable educational tool in emergency medicine. It is recommended by international resuscitation guidelines, has been shown to improve both patient outcomes and resuscitation team performance, and is frequently requested by medical learners. However, there is limited research comparing standardized debriefing frameworks. Not only does this hinder the ability of interested emergency departments (EDs) to adopt PRD, but it limits the quality of future debriefing research. We sought to identify and compare existing PRD frameworks to inform the implementation of effective PRD in emergency medicine.

Methods: We conducted a systematic review following PRISMA standards to identify debriefing frameworks used in the ED and other acute care settings for further analysis. Identified frameworks were analyzed and compared based on a method previously described in the literature.

Results: Our search identified six frameworks, which ranged from simple tools for immediate feedback to complex, hospital-wide systems engineering–based approaches to quality improvement. Key findings were the importance of ensuring debriefing facilitators are properly selected and trained and of tailoring framework design to specific organizational targets. However, there is limited validation data for these frameworks, and more study is needed to identify and validate true best practices in PRD.

Conclusions: All six identified frameworks seem to be effective methods of debriefing. Given the breadth of debriefing methods and goals identified, this suggests that there may not be a one-size-fits-all approach to PRD and that organizations should instead identify their own unique needs and barriers and adopt the debriefing framework that best addresses those needs. Other findings were the importance of well-trained debriefing facilitators and the use of clear roles in organizing debriefings. Further research is needed to assess the effectiveness of postresuscitation frameworks with regard to both team performance and patient outcomes.

Postresuscitation debriefing (PRD) is an important application of debriefing in the practice of emergency medicine and is recommended by resuscitation guidelines and emergency medicine organizations in the United States, Canada, and Europe.1-3 The purpose of PRD is to facilitate reflective discussion of actions and thought processes, providing the opportunity for experiential learning.4,5 This discussion allows for both interpersonal feedback and the identification of larger systems-level issues in patient care.

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Although the benefits of formal PRD frameworks are established in simulation-based resuscitation education, there is limited research into the application of PRD in real-world health care settings. PRD has been shown to improve patient outcomes on a number of measurable factors including the rate of return of spontaneous circulation, neurologic outcomes, hand-off time for chest compressions during cardiopulmonary resuscitation (CPR), and delay in initiating chest compressions. Furthermore, PRD has been shown to be beneficial for health care providers, reducing stress, and helping providers feel more comfortable and competent in their role during resuscitations.

Despite these wide-ranging benefits, there is limited use of formalized PRD in emergency medicine. Studies have shown that medical learners of all levels desire greater use of formalized PRD, which has been found to reduce anxiety among learners. While debriefing may be used informally following critical events, a lack of standardization can limit the use of debriefing and effectiveness of these sessions.

Recent studies have outlined the development and implementation of standardized debriefing frameworks in the emergency department (ED) and elsewhere within acute care medicine. However, these different methods take markedly different approaches to PRD. Furthermore, there are limited data regarding the effectiveness of these frameworks in improving learner education, team function, and patient outcomes. The objective of this systematic review was to identify and compare existing debriefing frameworks to facilitate the adoption of formalized debriefing frameworks within the ED.

METHODS

We performed a systematic review using PRISMA guidelines to identify PRD frameworks used in both emergency medicine and elsewhere in acute care medicine. PubMed, Ovid Medline, CINAHL, and Cochrane Database of Systematic Reviews were searched for studies reporting the use of a PRD framework in both real-world and simulation settings. Reference lists from all papers and gray literature were also searched (please see Data Supplement S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1002/ae2.10444/full, for full search strategy details including detailed inclusion and exclusion criteria). Articles were screened in duplicate by SH and AK, with any disagreements resolved by consensus. The final search was performed February 13, 2020. Papers that met the final inclusion criteria were analyzed using the Who-What-When-Where-Why-How model for analyzing debriefing methods previously described by Raemer et al. and Kessler et al.

RESULTS

Search results are presented in Figure 1. Our search strategy returned 2,741 total results. A total 696 duplicates were removed, leaving 2,045 unique results. A title and abstract screen was used to identify papers that specifically discussed debriefing. This screen identified 96 papers. Our eligibility criteria for final inclusion were: 1) the paper must include a debriefing framework, 2) the paper must describe the framework in sufficient detail for both analysis and real-world implementation, and 3) the debriefing framework must be appropriate for a real-world PRD in the ED. For a paper to be considered appropriate for real-world PRD, it had to both satisfy Lederman’s definition of debriefing as a process of reflective discussion and, if the paper were based in a simulation setting, be easily translatable for real-world ED use. Six papers met these eligibility criteria for final analysis (Table 1). The DISCERN, INFO, and Post Code Pause (PCP) frameworks were specifically designed and presented as methods for ED PRD. REFLECT was designed for simulation debriefing but determined to be appropriate for real-world use. The PediRes-Q and the Christiana Care Health System (CCHS) debriefing studies were designed for general in-hospital use but determined to still be appropriate for the ED setting. CCHS, INFO, and PediRes-Q were multicenter studies (CCHS and INFO within their given health system, and PediRes-Q an international study), while DISCERN, PCP, and REFLECT were used within a single department. The findings of our analysis are summarized in Table 2.

ANALYSIS

Why

The most common approach to debriefing is using the Plus-Delta method (working to find areas of improvement rather than assigning blame) to identify limitations in individual and team performance as well as larger process-level issues, as used in DISCERN,
INFO, PCP, and PediRes-Q. REFLECT was the simplest tool identified with a focus on giving efficient, direct interpersonal feedback. CCHS was the most complex and widely scoped, explicitly avoiding individual feedback, and using a just culture and systems engineering approach to identify and solve patient care issues. PCP is unique in that its primary goal is not just direct performance improvement as is typical in PRD, but it also targets the emotional and psychological performance of health team members following potentially stressful and traumatic events.

Who
All six frameworks identify the importance of selecting and training effective facilitators. Rather than train all potential facilitators, CCHS specifically targeted leaders with skill sets believed to be beneficial for debriefing. The REFLECT study found that the combination of facilitator training and use of the REFLECT tool significantly improved the ability of the facilitator to discuss how debrief data could be used for future improvement. In tools where the facilitator role was left unspecified, the vast majority of debriefs were led by physicians (over 90% for both DISCERN and Pedi-ResQ), whereas INFO and PCP specifically trained and designated ED nurses to facilitate debriefs to reduce the time demand and cognitive loading on ED physicians. In particular, INFO targeted charge nurses, because they would not have immediate clinical duties following a resuscitation and would have

Figure 1. PRISMA flow chart of search results.
good overall awareness of the state of the ED. All frameworks that commented on who should participate in debriefing encouraged the entire resuscitation team to attend the debrief. CCHS expects all invitees that do attend the debrief to act as content matter experts for their given field, and specifically requires all trainees to attend (other frameworks did not comment on any mandatory participants).

**What**

The unpredictable nature of the ED presents significant environmental barriers to debriefing. To overcome these barriers, a PRD framework requires clear guidance on not only when to debrief, but when a debrief is not necessary. This is clear from PediRes-Q, which showed debriefing rates ranging from 0% of trigger events to 100% of trigger events depending on the specific site within its multicentre study (other multicenter studies did not report per-site data). The ED-focused frameworks used similar mandatory debriefing triggers: any resuscitation requiring CPR, any intubation, and any staff request for debriefing. Rather than triggers based on specific interventions CCHS used triggers related to patient outcomes, with debriefing considered after any unanticipated poor outcome, unanticipated patient death, or other sentinel event. However, it is important to ensure that these triggers are not too broad as debriefing too frequently may be detrimental by inducing fatigue and diverting resources from patient care: for example, PCP removed a pediatric trauma trigger as these patients rarely required resuscitation. DISCERN presented a novel solution by having both the patient’s physician and primary nurse meet immediately after a trigger event to decide if a full debrief was necessary. Of the 120 DISCERN resuscitations that were not debriefed, 78% indicated that debriefing was not considered necessary and 19% indicated “too many patient care issues” (other tools did not track reasons for not debriefing).

**When and Where**

Debriefing is typically divided into “hot” and “cold” debriefs. Hot debriefs occur as soon as possible after an event, while cold debriefs can take place days or even weeks later to allow for data collection and additional participants. Hot debriefs also tend to be much quicker, typically lasting 5 to 15 minutes, whereas cold debriefs are typically more formalized meetings and may run for an hour or longer. Hot debriefing is far more common in emergency medicine.

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**Table 1**

<table>
<thead>
<tr>
<th>Framework</th>
<th>Source</th>
<th>Year</th>
<th>Country</th>
<th>Setting</th>
<th>Number of Deb briefings</th>
<th>Length of Study</th>
<th>Debriefing Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCHS</td>
<td>Campbell et al.22</td>
<td>2014</td>
<td>United States</td>
<td>Hospital-wide</td>
<td>204</td>
<td>72 months</td>
<td>Unanticipated patient complications, staff request</td>
</tr>
<tr>
<td>DISCERN</td>
<td>Mullan et al.18</td>
<td>2013</td>
<td>United States</td>
<td>Pediatric ED</td>
<td>63</td>
<td>12 months</td>
<td>CPR, intubation, defibrillation, or staff request</td>
</tr>
<tr>
<td>INFO</td>
<td>Rose and Cheng20</td>
<td>2018</td>
<td>Canada</td>
<td>ED</td>
<td>254</td>
<td>19 months</td>
<td>Code blue on arrival</td>
</tr>
<tr>
<td>PCP</td>
<td>Copeland and Liska19</td>
<td>2016</td>
<td>United States</td>
<td>Pediatric ED</td>
<td>47</td>
<td>12 months</td>
<td>Pediatric in-hospital cardiac arrests</td>
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<tr>
<td>PediRes-Q</td>
<td>Sweberg et al.23</td>
<td>2018</td>
<td>Multinational</td>
<td>Pediatric inpatient (multicenter)</td>
<td>108</td>
<td>19 months</td>
<td>Pediatric in-hospital cardiac arrests</td>
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<td>REFLECT</td>
<td>Zinns et al.21</td>
<td>2017</td>
<td>United States</td>
<td>Pediatric emergency (simulation)</td>
<td>18</td>
<td>1 month</td>
<td>Not applicable (simulated resuscitations)</td>
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<tr>
<td>Why</td>
<td>CCHS</td>
<td>DISCERN</td>
<td>INFO</td>
<td>PCP</td>
<td>PediRes-Q</td>
<td>REFLECT</td>
<td></td>
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<tr>
<td>Stated goal</td>
<td>Identify systems-level barriers</td>
<td>Improve team function, identify QI targets</td>
<td>Develop a feasible and sustainable charge nurse-facilitated debriefing framework</td>
<td>Address psychological and spiritual effects of repetitive exposure to traumatic events</td>
<td>Identify frequency, process, and content of hot debriefings in a multicenter trial</td>
<td>Improve feedback quality, communication</td>
<td></td>
</tr>
<tr>
<td>Underlying debriefing principle</td>
<td>Just culture, systems engineering</td>
<td>Plus/delta</td>
<td>Plus/delta</td>
<td>Operational debriefing</td>
<td>Plus/delta</td>
<td>Plus/delta</td>
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</tr>
<tr>
<td>What</td>
<td>Trigger events</td>
<td>Unexpected patient harm or death, staff request</td>
<td>Any event involving CPR, intubation, or fibrillation, staff request</td>
<td>CPR, intubation, Level I trauma, staff request</td>
<td>Code blue on arrival</td>
<td>Pediatric in-hospital cardiac arrest ≥ 1 min</td>
<td>Simulation</td>
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<tr>
<td>Framework standard</td>
<td>24–48 hours after event, preliminary immediate debriefing if necessary</td>
<td>MD and primary nurse initially decide whether to fully debrief; full debriefing “ASAP” if necessary</td>
<td>“As soon as possible”</td>
<td>“As soon as feasible”</td>
<td>“Minutes to hours” after initial event</td>
<td>Immediate</td>
<td></td>
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<tr>
<td>When and Where</td>
<td>Hot or cold debrief</td>
<td>Cold</td>
<td>Hot</td>
<td>Hot</td>
<td>Hot</td>
<td>Hot</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Off-site</td>
<td>On-site</td>
<td>On-site</td>
<td>On-site</td>
<td>On-site</td>
<td>On-site</td>
<td></td>
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<tr>
<td>Who</td>
<td>Facilitator</td>
<td>Specifically selected for facilitation skills</td>
<td>Trained pediatric EM physician</td>
<td>Charge nurse</td>
<td>Primary RN</td>
<td>(Not reported)</td>
<td>Trained pediatric EM fellow</td>
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<tr>
<td>Participants</td>
<td>Resuscitation team, residents, admin staff</td>
<td>Resuscitation team</td>
<td>Not specified</td>
<td>Resuscitation team</td>
<td>(Not reported)</td>
<td>Resuscitation team</td>
<td></td>
</tr>
<tr>
<td>Learners</td>
<td>Required to attend</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Required to attend (simulation)</td>
<td></td>
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<tr>
<td>How</td>
<td>Overall tool complexity</td>
<td>Complex</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Simple</td>
<td>Simple</td>
<td></td>
</tr>
</tbody>
</table>

QI = quality improvement.
and used in DISCERN, REFLECT, INFO, PediRes-Q, and PCP. Interestingly, despite its two-step debriefing approach, DISCERN reported an average time to debrief of 33 minutes compared to 130 minutes in PediRes-Q, with other papers not reporting time to debrief data.

**How**

All six debriefing methods made use of a physical debriefing tool. REFLECT uses a simple list of the REFLECT mnemonic. PCP, DISCERN, PediRes-Q, and INFO all featured tools collecting basic patient information, attendance, and set questions for the facilitator to ask with space to record answers from the team. PCP also called for health care worker wellness pamphlets to be handed out at each debrief so that participants could better identify and support individuals in emotional distress. DISCERN included two unique features. The first is a section for the physician and nurse to sign off on if they determined a debrief was not necessary, allowing for better data collection regarding debrief rates which would be valuable for quality improvement (QI) purposes. The second is specific yes/no questions about performance improvement targets (“was anyone other than the physician team leader calling medication orders?” and “was anyone confused about who the physician team leader was at any time during the resuscitation”). CCHS also uses a standardized debrief checklist for facilitators to run through, but additionally uses time between the event and debrief to develop a clinical abstract outlining the facts and timeline of the triggering event in the 24 to 48 hours prior to the debriefing.

**DISCUSSION**

Postresuscitation debriefing has been demonstrated to improve clinical performance in three important domains. First, it has been shown to improve patient outcomes, including CPR quality and rate of return of spontaneous circulation.8-10 Second, regular training and debriefing has been shown to improve communication and team skills by improving the accuracy and recall of participants, as well as the quality of feedback delivered.1-7 Finally, PRD is highly desired by medical learners and been shown to reduce anxiety among learners during subsequent resuscitations.13 Pediatric EM fellows have overwhelmingly reported that they would like more PRD training, with studies showing almost 90% of fellows report receiving no formal PRD training at all.29,30 The widespread adoption of PRD is likely to improve patient outcomes and resuscitation team function and may be particularly useful in academic centers when integrating and training medical learners.

In analyzing the identified debriefing frameworks, all six frameworks seem to be effective methods of debriefing. All frameworks reported the successful implementation of their debriefing method and highlight some form of improvement in the quality of debriefing (DISCERN, INFO, PediRes-Q, REFLECT), patient care (CCHS), or health team functioning (PCP). One of the main challenges of implementing PRD is overcoming perceived barriers such as a lack of time for debriefing, and it has been suggested that the process of debriefing in and of itself may be more important than the specific method.31,32 In the context of this review’s results, this proposes a model where the most important aspect of choosing a debriefing method is ensuring a debriefing method is a good fit for a department’s specific needs, and therefore the best approach may be to identify department-specific barriers and then adopt (and adapt as necessary) the framework that best fits those needs. This is clear from the PediRes-Q study, which found debriefing rates ranging from 0% to 100% of trigger events depending on the particular study site measured, even though all sites used the same debriefing method and standards.23 The INFO tool in particular highlights how frameworks can be modified to meet those goals and address a department’s unique needs, modifying the DISCERN framework into a charge nurse-facilitated method. INFO’s use of charge nurse facilitators may be particularly effective at overcoming the perceived time barrier to debriefing, as their greater awareness of the state of the ED may allow them to schedule debriefs at times when as many participants as possible are free from immediate clinical duties.20

All six frameworks highlight that effective training and clear debriefing roles are important for effective PRD. Studies have shown that debriefing may have a greater impact when baseline performance is relatively low (especially with respect to adhering to recommended practice guidelines) and that high-quality feedback specifically is associated with improved performance, and therefore it is important that facilitators be properly trained to maximize the benefits of debriefing.33 PCP raises the importance of considering not only debriefing facilitation from a team performance perspective but also the potential stress and
psychological trauma of difficult resuscitations. CCHS took the unique approach of identifying and training specific leaders who were thought to be strong facilitators, and this may be a good way to ensure both quality debriefing and department buy-in during the early stages of rolling out a debriefing framework. However, this approach would largely be limited to cold debriefs where the ability to select a specific facilitator is possible, although identifying and training individuals to work as debriefing “champions” within a department may still be valuable for hot debriefing methods.

INFO and PCP highlight the value in moving beyond the assumption that physicians should be the individuals leading debriefing and that nurse facilitators may improve debriefing by not adding additional cognitive loading or time demands on ED physicians. DISCERN used a unique two-step approach to limit the time demands of debriefing, allowing the patient’s physician and primary nurse to decide if a full team debrief is necessary. This approach may be valuable from a data collection and QI perspective, as it still allows for useful data capture in the event of a resuscitation that is not debriefed. DISCERN also used focused, simple yes/no questions as part of its debrief (e.g., “was anyone other than the physician team leader calling medication orders?” which again would be useful for QI purposes. Interestingly, even with this more complicated two-step approach DISCERN reported a much shorter median time to debrief than PediRes-Q, suggesting its requirement to have the patient’s physician and nurse discuss whether a debrief is necessary may prime them to debrief sooner than if left to make a decision individually (although this could also be explained by other factors, including PediRes-Q’s different “minutes to hours” timing standard and inpatient setting).

LIMITATIONS

The main limitation of this review is the continued lack of data on real-world PRD. There are limited data available surrounding implementations of debriefing in either the ED or health care in general and even the identified frameworks have limited validation, especially in terms of effect on patient outcomes.7,34,35 This review found no studies directly comparing the efficacy of real-world debriefing frameworks, and the identified frameworks did not report data in a consistent manner that would allow for comparisons to be made. Therefore, we are unable to make concrete recommendations as to whether one PRD method is more effective than another, and future studies should focus on identifying how different aspects of debriefing improve patient outcomes and/or team function.

CONCLUSION

Postresuscitation debriefing is an important tool for improving patient outcomes and resuscitation team performance and provides the opportunity for essential training and learning opportunities. All six frameworks identified by this review have unique advantages and seem effective based on both their own data and literature from the field. This suggests that tailoring a debriefing method to organizational goals and preferences is the best way to implement effective postresuscitation debriefing practices. Future studies should focus on taking this knowledge and implementing comparative studies and/or studies with robust real-world validation to provide a concrete base for comparison of different postresuscitation debriefing methods.

References


Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10444/full

Data Supplement S1. Full Search Strategy Details.
Focused Research Infrastructure for Postgraduate Pediatric Emergency Medicine Fellows Increases Dissemination of Scholarly Work

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ABSTRACT

Background: Many fellows in clinically driven subspecialties may have difficulty completing and publishing their scholarly projects due to lack of prior experience in research, selection of projects that are difficult to complete during fellowship, or mentorship challenges. This may be particularly true in pediatric emergency medicine (PEM) because research time may be longitudinally integrated with clinical rotations, rather than blocked as is common in other subspecialties. We describe the creation and outcomes of a structured program to increase academic productivity of PEM fellows.

Methods: This was a retrospective cohort study of scholarly productivity (publications in peer-reviewed journals, presentation at national meetings) for PEM fellows over 17 years in one fellowship program, before and after the implementation of a structured program. We reviewed obstacles to publication for prior fellow projects when developing the curriculum. Our multifaceted program consisted of milestone development, four in-person committee meetings, and abstract and manuscript development workshops. We utilized existing faculty members, most of whom were junior faculty, as committee members. Our primary outcome was the percentage of fellows who were first authors for peer-reviewed publications for their fellowship projects. National conference presentations were the secondary outcome.

Results: Data for 76 PEM fellows were eligible for analysis: 44 (58%) before and 32 after programmatic implementation. There was a statistically significant increase in the percentage of fellows who published their studies (32% vs. 63%; odds ratio [OR] = 3.6, 95% confidence interval [CI] = 1.4 to 9.3) after programmatic implementation. There were no differences in conference presentations (45% vs. 63%; OR = 2.0, 95% CI = 0.8-5.1) after implementation.

Conclusions: Utilizing a small group of existing, predominantly junior faculty members, we created a structured program that enhanced PEM fellows’ scholarly productivity and increased publications. We believe that this model is sustainable for and generalizable to other PEM fellowship programs.
The Accreditation Council for Graduate Medical Education requires postdoctoral fellows in pediatric subspecialties to participate in scholarly activities, and the American Board of Pediatrics (ABP) requires a written work product of scholarly activity to become board-certified in a pediatric subspecialty. While “scholarly activity” is defined broadly, fellows in more clinically driven subspecialties may find it difficult to take a project from inception to fruition with little assistance. In particular, this may be the case for fellows who did not have the opportunity to participate in research prior to fellowship, or this may occur in programs that do not have many midcareer or senior mentors. Fellows may also experience challenges in programs that longitudinally integrate research time with clinical rotations, rather than having the research time in dedicated blocks.

There is no optimal approach to increasing scholarly productivity. General strategies for trainees and the junior faculty who often mentor them have included incentivizing scholarship, increasing awareness of the academic productivity of peers, and highlighting scholarship at designated research days. Others have tailored interventions to overcome specialty-specific obstacles. Many interventions have been contingent upon recruitment of additional human, financial, or educational resources within or external to the subspecialty, potentially resulting in less generalizable or sustainable models. We describe the development and outcomes of the Advisory Committee for Excellence in Research (ACER), a program using a structured approach and mentorship from a committee of existing clinical faculty to guide pediatric emergency medicine (PEM) fellows to successful completion and dissemination of their scholarly activities, without hiring of outside faculty or research staff.

**METHODS**

**Study Design, Population, and Setting**

This was a retrospective review of scholarly activity for a cohort of fellows completing PEM fellowship at an urban, quaternary care, freestanding children’s hospital. PEM fellows were eligible for inclusion if they began and successfully completed their fellowship between July 2000 and June 2017; these dates were chosen to reflect the period during which a research requirement was formalized by the ABP. We excluded fellows who met the ABP scholarly project requirement from a prior fellowship. We performed analyses for all fellows and pediatric pediatric-trained PEM fellows, as there was a board requirement for scholarly activity for the latter. Although EM residency-trained fellows participated in ACER, the American Board of Emergency Medicine (ABEM) does not require a written work product of scholarly activity for certification in PEM and because they had a shorter fellowship during which to complete projects.

Our fellowship accepted two to four fellows per year from 2000 to 2005 and five or six fellows per year thereafter. At the onset of the study period, there were 12 PEM subboard–certified/eligible faculty (a median of 5 years out of training; interquartile range (IQR) = 1.75 to 6.5 years), which increased to 47 by 2017 (a median of 8 years out of training, IQR = 3 to 16 years). We calculated years out of training using the faculty member’s PEM fellowship graduation year. For faculty who attained PEM board certification prior to the joint ABP/ABEM requirement for fellowship training, years out of training were calculated using the faculty member’s residency graduation year. The institutional review board (IRB) determined that the study was exempt from review.

**Identification of the Problem/Perceived Barriers**

Prior to implementing ACER, fellowship exit interviews with graduating fellows and review of their work products submitted to the ABP identified that many PEM fellows were meeting the scholarly activity requirement by writing progress reports on their research, with ill-defined plans for project completion and manuscript publication. Barriers to having a completed project/manuscript at the time of graduation included lack of time, complex projects with prospective subject enrollment, projects that involved more data collection than initially anticipated, fellow perception of insufficient skills with data analysis and manuscript preparation, and competing responsibilities with their jobs after fellowship for trainees whose projects were still outstanding at the time of graduation.

**The Committee**

The ACER was created in 2009 by two authors (ATC, MIS) who at the time were 0 to 2 years out from training, with the support of the former and current fellowship program directors (DCH, CBD, EMS), and is now led by the research education directors (CEC, SDM). At ACER’s inception, there were 29 PEM faculty in the section, the median of whom were...
6 years out of training (IQR = 2–13 years). Four of them (median of 3 years out of training, range = 0 to 9 years) composed the initial core group of ACER faculty. ACER held research-specific meetings that focused on discussing educational and traditional, biomedical, or clinical research once per month and discussed global health, quality improvement, child abuse, and traditional research on another day per month. This enabled other faculty with these specific areas of interest the flexibility to preferentially attend certain meetings on an ad hoc basis. Fellows were encouraged to develop projects meeting feasible, interesting, novel, ethical, relevant (FINER) goals.

Core faculty members with either prior expertise (midcareer faculty) or developing interest (junior faculty) in study design and research methodology attended all meetings. Many faculty were invited to join ACER shortly after completing fellowship based on their identified areas of interest within the PEM subspecialty. Upon joining ACER, few faculty had a substantial number of publications, allocated research time, or research grant funding. Six total faculty hours/week were allocated to research education, which included ACER as well as didactic series.

**ACER Meetings and Curriculum**

The committee met twice monthly for 2 hours/session with PEM fellows. Up to three fellows presented projects each session. Presentation at four ACER sessions was mandatory for first-year fellows beginning in 2010. Sessions occurred predominantly during the first year, except for PEM-global health fellows, who had meetings extending into their second year after completing their first global health rotations. Fellows were protected from clinical responsibilities to attend these meetings and were encouraged to attend with their research mentors. Attendance of other research personnel (e.g., epidemiologist, statistician) occurred at some of the latter meetings. Solely serving as faculty on ACER was not sufficient for faculty to be authors on fellows’ manuscripts. All fellows were advised to have their co-authors adhere to the authorship criteria defined by the International Committee of Medical Journal Editors.8

Advisory Committee for Excellence in Research meetings were incorporated into each fellow’s timeline for scholarly project development. Fellows also received ongoing reminders during their research didactic conferences and meetings with their mentors and program directors, with delays resulting in more frequent meetings and discussions with research mentors and fellowship program directors. As part of the ACER process, contingency plans were made to transfer first authorship to their research mentor if the fellow failed to complete and submit their manuscript within 12 months of fellowship graduation.

The ACER curriculum consisted of four iterative meetings focused on addressing key components of a successful research project and identifying potential barriers early in the project. The goal by the end of these four meetings was for the fellow to have a well-designed, interesting, novel, ethical, and relevant project that was feasible to complete in a 3-year fellowship. We expected fellows to perform the following tasks prior to the first ACER meeting: 1) identify a research mentor; 2) develop research question(s) in patient, intervention, comparison, outcome (PICO) format; 3) conduct a literature review; and 4) prepare a project proposal with help from their research mentor. The proposal was submitted to ACER directors in time for distribution to the remaining ACER faculty at least 1 week prior to the scheduled first meeting. Faculty provided edits and comments on the document that was serially circulated to committee members. In later years, this was done using a secured cloud-based platform (Box.com) to allow reviewers to lock the protocol while editing, thus allowing for the fellow to receive all comments on one document. At the first ACER meeting, this document was projected on a screen and edited further during real-time discussions with the fellow, their research mentor, and all ACER faculty present at the meeting. This edited version was returned to the fellow/research mentor following the meeting. By the completion of their fourth ACER meeting, which occurred within 9 months of their first meeting, fellows had a project proposal ready for IRB submission and were ready to begin data collection immediately following IRB approval.

**ACER Curriculum Objectives**

The objectives of the ACER curriculum were to equip the fellow to perform six tasks for their project, three relating to study design and three related to presentation of the data. The three objectives regarding study design were 1) development of PICO questions; 2) creation of a novel project that can be completed by the end of fellowship, using FINER aims; and 3) definition of the study design, population, intervention (if appropriate), and statistical plan. The three objects regarding data presentation were 1) analysis and
description of results, 2) formulation of conclusions, and 3) dissemination of knowledge beyond the institution.

**Accompanying Research Curriculum**

Advisory Committee for Excellence in Research was augmented by an accompanying research curriculum to equip PEM fellows with the skills to conduct their scholarly projects from start to finish over the course of their fellowship. Our PEM research curriculum consisted of two tracks, each presented monthly during regularly scheduled fellowship didactic conferences. Track 1 was designed for first-year fellows and focused on the basics of study design, including formulating a study question, searching and appraising the literature, developing a detailed study design, laying a foundation in understanding statistics, and obtaining IRB approval. Track 2, for second- and third-year fellows, provided instruction on data collection and analysis, platform and poster-based scientific presentation skills, and manuscript writing. Changes to Track 2 of the PEM research curriculum after 2009 included development of abstract writing workshops and several manuscript writing workshops for which faculty would provide both written feedback prior to the workshop and in-person feedback during the workshop on drafts of one portion of the fellows’ manuscripts. We designed workshops for the introduction, methods, results, and discussion. We also continued quarterly mandatory meetings (Progress in Research) during which all second and third-year fellows updated the group (ACER members, other fellows, and other section faculty) on progress and barriers to their research as well as planned next steps. They reviewed progress made during the last 3 months, barriers faced, and next steps. This process allowed us to identify common problems across studies, troubleshoot solutions, and allowed the fellows to share best practices with each other.

**Outcomes and Analyses**

Our primary outcome was the percentage of fellow projects that resulted in manuscript publication as a first author in PubMed-cited peer-reviewed journals. One author (ATC) performed a literature search to augment the existing internal database tracking fellow publications. Our secondary outcome was the percentage of projects presented at national meetings. Presentations at local/regional conferences, case reports, and publications in non-peer-reviewed journals were excluded. Data were reported using percentages and means/medians. Fellow productivity was stratified a priori based on starting fellowship before and after 2009, when ACER was initiated, using chi-square or Fisher’s exact tests (Stata 14, Stata, Inc.).

**RESULTS**

The suggested research milestones, ACER curriculum, and proposal are described in Tables 1 and 2 and Data Supplement S1 (available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1002/ae2.10402/full), respectively. Fellows who met inclusion and exclusion criteria are quantified in the Figure 1, and the fellows’ demographics and projects are summarized in Table 3. Academic productivity is summarized in Table 4. There was a statistically significant increase in the percentage of fellows who published their studies, regardless of whether or not there was a research requirement for board certification. There were no differences in conference presentations after ACER implementation. All fellows in both time periods met ABP requirements for board certification; fellows who did not have a published manuscript or manuscript ready for submission had sufficient data to submit interim progress reports to the ABP.

**DISCUSSION**

We report the results of a structured educational intervention to optimize scholarly productivity of our PEM fellows. We observed an increase in publications during the study period. We did not notice an increase in abstract presentations, potentially because of the differing criteria for abstract versus paper acceptance. We feel that our results are sustainable and can be generalized to other settings for several reasons. First, our program was not contingent upon being able to recruit additional faculty. Second, the program allowed quite junior faculty members to serve as effective mentors for fellows, augmenting teaching and development opportunities for faculty early in their careers. Third, by combining research experiences and having multiple faculty provide mentorship, we were able to provide fellows with more diverse feedback in a structured manner.

Prior studies detailing methods of augmenting scholarly productivity have used additional resources, either within or outside of the specialty. However,
Table 1
Milestones Within Timeline for Scholarly Activity Project

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Time Frame (Months)</th>
<th>Target Year/Quarter for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Formulating the topic: 1st year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brainstorm for potential topics</td>
<td>3</td>
<td>Y1Q1</td>
</tr>
<tr>
<td>Meet with potential mentors</td>
<td>5</td>
<td>Y1Q2</td>
</tr>
<tr>
<td>Literature review</td>
<td>3</td>
<td>Y1Q2</td>
</tr>
<tr>
<td>Written protocol (preliminary)</td>
<td>2</td>
<td>Y1Q2</td>
</tr>
<tr>
<td>Develop the question</td>
<td>1–3</td>
<td>Y1Q2</td>
</tr>
<tr>
<td>Define the population</td>
<td>1–3</td>
<td>Y1Q2</td>
</tr>
<tr>
<td>Define the intervention or exposure</td>
<td>1–3</td>
<td>Y1Q2</td>
</tr>
<tr>
<td><strong>Establishing the research question: first year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meet with epidemiologist and select study design</td>
<td>3</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Identify primary and secondary outcomes</td>
<td>4</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Meet with statistician and calculate sample size</td>
<td>2</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Query databases to determine time frame for enrolling needed number of patients</td>
<td>3</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Meet with research support staff</td>
<td>3</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Author identification</td>
<td>3</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Present at PEM fellows’ conference</td>
<td>3</td>
<td>Y1Q3</td>
</tr>
<tr>
<td>Write the IRB</td>
<td>2</td>
<td>Y1Q4</td>
</tr>
<tr>
<td>Determine target journal</td>
<td>0.25</td>
<td>Y1Q4</td>
</tr>
<tr>
<td><strong>Data collection, validation, and analysis: 1st-3rd year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create data collection tool</td>
<td>2</td>
<td>Y2Q1</td>
</tr>
<tr>
<td>Pilot the tool</td>
<td>1</td>
<td>Y2Q1</td>
</tr>
<tr>
<td>Finalize forms</td>
<td>1</td>
<td>Y2Q1</td>
</tr>
<tr>
<td>Begin collecting data</td>
<td>12–15</td>
<td>Y2Q2</td>
</tr>
<tr>
<td>Finish data collection</td>
<td></td>
<td>Y3Q1</td>
</tr>
<tr>
<td>Data cleaning and validation</td>
<td>2</td>
<td>Y3Q1</td>
</tr>
<tr>
<td>Data analysis with statistician</td>
<td>2</td>
<td>Y3Q2</td>
</tr>
<tr>
<td>Abstract writing workshop</td>
<td></td>
<td>Y3Q2</td>
</tr>
<tr>
<td>Renew IRB annually</td>
<td>0.1</td>
<td>Y2Q4, Y3Q4</td>
</tr>
<tr>
<td><strong>Manuscript preparation: 2nd-3rd year</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review previously written abstract and repeat literature search for new articles on the topic</td>
<td>0.1</td>
<td>Y3Q2</td>
</tr>
<tr>
<td>Review journal selection with mentor</td>
<td>0.1</td>
<td>Y3Q2</td>
</tr>
<tr>
<td>Format using journal’s “instructions to author”</td>
<td>1–2</td>
<td>Y3Q3</td>
</tr>
<tr>
<td>Receive edits from other authors and incorporate</td>
<td>1</td>
<td>Y3Q3</td>
</tr>
<tr>
<td>Submit manuscript to journal</td>
<td>0.1</td>
<td>Y3Q3</td>
</tr>
<tr>
<td>Make appropriate revisions based upon reviewer commentary</td>
<td>1–2</td>
<td>Y3Q4</td>
</tr>
</tbody>
</table>

ILP = individualized learning plan; IRB = institutional review board; PEM = pediatric emergency medicine; Q = quarter; Y = year

Table 2
Overview of the Curriculum

<table>
<thead>
<tr>
<th>Meeting No.</th>
<th>Topic</th>
<th>Attendees*</th>
<th>Goals of session</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Study question</td>
<td>Core</td>
<td>Create and refine the research question</td>
</tr>
<tr>
<td>2</td>
<td>Study population</td>
<td>Core</td>
<td>Finalize study design, Establish study period and inclusion/exclusion criteria</td>
</tr>
<tr>
<td>3</td>
<td>Data collection</td>
<td>Core; epidemiologist</td>
<td>Specify variable types, Identify how data can best be collected (e.g., existing data sets, abstraction from the EHR)</td>
</tr>
<tr>
<td>4</td>
<td>Data analysis</td>
<td>Core; biostatistician</td>
<td>Estimate sample size, Determine appropriate analysis methods</td>
</tr>
</tbody>
</table>

EHR = electronic health record.
*All sessions were attended by core pediatric emergency medicine research faculty (including the fellowship program directors), the fellow, and (optimally) the research mentor.
108 were fellows during the study period

77 met inclusion criteria

76 analyzed

44 pre-intervention

32 post-intervention

10 began fellowship before the study period

17 completed fellowship after the study period

4 did not successfully complete fellowship

77 met inclusion criteria

Excluded: No Project Required

1 completed a prior fellowship

Figure 1. Population for data analysis.

Table 3
Demographics of the Fellows and Fellow Projects*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Subcategory</th>
<th>Pre-ACER (n = 44), n (%)</th>
<th>Post-ACER (n = 32), n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board certification</td>
<td>Eligibility for board certification</td>
<td>44 (100%)</td>
<td>32 (100%)</td>
<td>1</td>
</tr>
<tr>
<td>Prospective or retrospective</td>
<td>Retrospective</td>
<td>18 (41%)</td>
<td>17 (53%)</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Prospective</td>
<td>26 (51%)</td>
<td>15 (47%)</td>
<td></td>
</tr>
<tr>
<td>Study Type</td>
<td>Clinical biomedical research</td>
<td>32 (73%)</td>
<td>13 (41%)</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>Educational</td>
<td>4 (9%)</td>
<td>3 (9%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Health services</td>
<td>3 (7%)</td>
<td>8 (25%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality improvement</td>
<td>3 (7%)</td>
<td>4 (13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Policy review</td>
<td>1 (2%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Basic biomedical research</td>
<td>1 (2%)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

ACER = Advisory Committee on Excellence in Research.
*Percentages reflect within-column percentages and may not sum to 100% due to rounding; this table includes data for EM- and pediatrics-trained fellows.

Table 4
Academic Productivity*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Subcategory</th>
<th>Pre-ACER, n (%)*</th>
<th>Post-ACER, n (%)*</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic productivity in all fellows</td>
<td>Fellows with published or accepted manuscripts</td>
<td>14/44 (32%)</td>
<td>20/32 (63%)</td>
<td>3.6 (1.4-9.3)</td>
</tr>
<tr>
<td></td>
<td>Fellows who presented at national meetings</td>
<td>20/44 (45%)</td>
<td>20/32 (63%)</td>
<td>2 (0.8-5.1)</td>
</tr>
<tr>
<td>Academic productivity in fellows for whom there was a research requirement†</td>
<td>Fellows with published or accepted manuscripts</td>
<td>12/40 (30%)</td>
<td>19/26 (73%)</td>
<td>4.5 (1.5-13.3)</td>
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<tr>
<td></td>
<td>Fellows who presented at national meetings</td>
<td>20/40 (50%)</td>
<td>18/26 (69%)</td>
<td>2.3 (0.8-6.4)</td>
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ACER = Advisory Committee on Excellence in Research.
*Percentages reflect within-column percentages and may not sum to 100% due to rounding.
†Pediatric-trained PEM fellows.
†In the pre-ACER period, 25 of 28 (89%) who did not publish did not submit a manuscript; in the post-ACER period two of seven (29%) had manuscripts rejected and five did not submit manuscripts (p = 0.56).
allocation of supplementary resources for academic work can be challenging in a clinical revenue-driven subspecialty such as PEM. Additionally, our program was not contingent upon recruitment of senior or midcareer faculty members to mentor the fellows. Rather, we had junior faculty, some of whom had just completed fellowship, serve on the advisory committee. This model allowed faculty to provide targeted feedback to fellows early in their projects, which was particularly important when there were project feasibility concerns. The focus on FINER goals for research may lead to a reduction in the number of prospectively conducted fellow projects, but also resulted in projects with relevant, focused clinical questions, including those involving quality improvement research, that were completed by the end of fellowship. Consequently, while manuscript development may have still been in process at the time a fellow graduated, data collection was at least complete. Use of an advisory committee allowed individuals to offer feedback on areas where they had relatively more expertise and not feel the onus of contributing in other domains in which they may have felt less comfortable. Having numerous individuals providing feedback also allowed the fellows’ faculty mentors to receive real-time feedback from other faculty on ideas conveyed. The fellows’ scholarly output may have increased over time since the quality of the feedback may have improved as the ACER faculty streamlined their workflow. Peer mentoring groups have been found to increase faculty members’ confidence in conducting research and academic productivity, suggesting that the benefits of an ACER model are bidirectional.

We had found that in the pre-ACER era, all fellows met the ABP scholarly requirements for graduation but less than half had national presentations and only one-third ultimately published their manuscripts. In the post-ACER era, two-thirds of the fellows had national presentations and ultimately published their manuscripts. We identified several potential barriers to publication: 1) lack of a focused research question which, while not precluding abstract acceptance, prevented publication; 2) inability to complete data collection during fellowship; and 3) difficulties with manuscript writing. We established ACER to address the first two issues and implemented manuscript workshops to aid with the third concern. Participation of the fellowship program directors both in ACER and in the workshops emphasized the importance of scholarly activity in a fellow’s professional development and was critical to the success of the program.

LIMITATIONS

There were limitations. More recently graduated fellows may still be working on publishing their projects, which would underestimate the impact of ACER. ACER was optional in 2009, so not all fellows may have benefited, and fellows graduating in 2010 and 2011 initiated projects pre-ACER. Fellows whose surnames changed may not have been included, underestimating productivity. This study predates scholarly activity participation requirements for residents, which may position more recent residency graduates better for fellowship research. Our section’s research infrastructure has improved over time, our faculty size has increased, and there has been minimal turnover among the research faculty, leading to a different demographic group than that present at the start of ACER. We did have faculty time (6 hours/week spread among several faculty members) for research education; however, most of the faculty time was not allocated from clinical hours. The ACER period overlapped with the period where electronic health records were introduced at the institution, potentially resulting in ease of data acquisition for retrospective studies. We do not have a record from the early years of manuscripts that were submitted for publication but rejected. As such, we cannot systematically report on reasons why submitted manuscripts were rejected, which would assist in improving ACER. The combination of increasing research expertise of the ACER faculty since program inception coupled with minimal faculty turnover has also contributed to programmatic success. We initiated ACER along with other interventions (e.g., manuscript workshops), making the specific impact of ACER as a stand-alone intervention challenging to measure. The generalizability of this method may be limited in other settings with smaller numbers of faculty members, high rates of faculty turnover, or less research infrastructure.

CONCLUSIONS

We report on the outcomes of a structured, sustainable program to increase PEM fellows’ scholarly output. PEM is a clinically driven subspecialty with fellows who often seek private, non–academically driven positions or academic positions that require little
scholarship after graduation. The rate of manuscript publication by fellows can be increased through implementation of a structured, interactive, serially delivered research curriculum.

References


Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10402/full

Data Supplement S1. Outline of the proposal.
FOAM Impact: The Influence of Open-access Medical Education on Practice Uptake

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ABSTRACT

Objectives: The FOAM Impact study sought to examine baseline rates of intravenous (IV) lidocaine usage for the treatment of renal colic and to compare rates of use between FOAM utilizers and nonutilizers. We sought to measure the effect of FOAM resources on clinical practice by timing the release of FOAM content with publication of the LIDOKET trial.

Methods: A cross-sectional before-and-after survey was conducted and disseminated on two social media platforms. The 13-question, anonymous survey was posted for 1 week prior following the release of the LIDOKET study. Descriptive statistics, Mann-Whitney t-test, and chi-square test statistics were used to describe survey respondent characteristics and Likert responses.

Results: There were a total of 472 survey respondents. A total of 321 physicians (75.7\% of total respondents) provided pre- and postpublication survey answers. There was no significant change in the use of analgesics before and after publication of LIDOKET and concurrent REBEL EM blog post. A total of 197 (42\%) survey respondents reported using lidocaine for renal colic, of which 60 respondents (13\%) reported frequent or occasional use. The mean difference in perceived efficacy of lidocaine before and after publication was \(-0.30\) (95\% confidence interval [CI] = \(-0.80\) to \(-0.19\), \(p = 0.15\)). Being a FOAM user was not associated with changes in mean difference in perception of lidocaine efficacy (\(F = 0.127, p = 0.72\)); however, there was a significant difference in perception of lidocaine’s efficacy following LIDOKET and REBEL EM publication (\(F = 4.718, p = 0.03\)).

Conclusions: Using an online survey-based technique, no appreciable impact of FOAM resources was immediately apparent; however, engagement with FOAM was associated with a change in perception of IV lidocaine’s efficacy. To our knowledge, this is the first study of its kind to evaluate the impact of FOAM on clinical practice. The unique method of coordinating FOAM distribution with traditional medical publication may provide future opportunities for measuring the impact of asynchronous medical education resources on medical practice.

In today’s age of advancing technology, it has become the norm to rely heavily on Internet resources to aid medical practice and continuing medical education. Online educational resources, social media, and asynchronous education increasingly dominate innovation and practice evolution for emergency physicians. With a plethora of options available, it is the physician’s responsibility to utilize reliable and...
effective resources. The “free open-access medical education” (FOAM) movement has harnessed the power of global connectivity to drive narrowing of the knowledge translation window. However, critics have urged caution in using online resources and warned that peer review or quality control is lacking.1-3

REBEL EM is an online educational resource widely used throughout the FOAM community, garnering 1,000 to 30,000 views/engagements per educational post and satisfying all quality indicators that have been previously identified as markers of reliability and usability for digital scholarship.4 “EM Docs” is an online Facebook community of nearly 20,000 members restricted to practicing and trainee emergency physicians. While discussion and debate are nearly instantaneous with experience and perspective from all over the world, the open-access nature of this resource lends it to satisfy few, if any, objective criteria of quality.

Generally, it is perceived that physicians who engage in social media educational resources have a higher baseline rate of uptake of “newer” or “cutting edge” clinical practices. While several publications have investigated reliability and quality of online resources, to our knowledge, no study to date has attempted to measure and compare the impact of social media resources on clinical practice.4-7

The primary objective of the FOAM Impact study was to examine the baseline rates of use of intravenous (IV) lidocaine in the treatment of renal colic. Given the fact that this analgesic technique is rather novel and not yet standard of care, the authors suspected that this practice would be relatively unique to FOAM engagers and interesting to study. In addition to practice patterns, the authors sought to compare differences in practice patterns between REBEL EM and emDOCs users following the publication of the LIDOKET trial and its concurrent REBEL EM blog post.8

Using an online survey-based technique, we sought to assess the impact of two different social media resources—REBEL EM and emDOCs—on clinical practice. Given advanced knowledge of the LIDOKET trial describing the utility of lidocaine in the treatment of renal colic, we coordinated release of a peer-reviewed FOAM blog post simultaneous with the publication of the LIDOKET trial in the American Journal of Emergency Medicine (January 2019). In an effort to gauge REBEL EM’s influence on practice, we measured clinician self-reported practices for the use of lidocaine in the treatment of renal colic both before and after the publication of the social media post and study, respectively, via an online survey.

METHODS

Study Design and Population
A cross-sectional, internet-based, before-and-after survey study was conducted from February 1, 2019, to March 1, 2019, which was approved by the Crozer-Keystone Institutional Review Board. The survey was disseminated on two social media platforms (Facebook and Twitter). The emDOCs Facebook page and REBEL EM website were chosen as the study populations. We hypothesized that health care providers on the emDOCs Facebook page and REBEL EM site were more likely to utilize FOAM for staying up to date with advancements in the literature compared to health care providers who subscribe to REBEL EM updates. All health care providers of both groups were eligible for inclusion in this study. Participants were excluded, however, if they completed only one of the two surveys.

Survey Design
A 13-question, anonymous survey was created and underwent multiple iterations of revisions. Survey questions included demographics (health care provider type, gender, number of years in practice) and utilization of and frequency of use of the aforementioned social media platforms. Three groups of questions focused on different modes of analgesia for renal colic (IV lidocaine, IV ketorolac, and opioids), namely, how often health care providers use each medication and the perceived effectiveness of each medication. Finally, for the group of questions on the use of IV lidocaine an additional question assessed where health care providers learned about the use of this medication for the treatment of renal colic (academic texts, formal training, FOAM, social media [Facebook or Twitter], or “I don’t use IV lidocaine”).

Survey Dissemination
The initial survey was posted on both platforms for 1 week prior to the LIDOKET study release. Following the release of the LIDOKET study and accompanying REBEL EM blog post, the survey was again posted for 1 week on both platforms.

Data Analysis
As an anonymous pretest/posttest survey without use of unique identifier codes of a large population, our
analysis plan assumed independence of observations and errors. Descriptive statistics, Mann-Whitney t-test, and the chi-square test statistic were used to describe survey respondent characteristics and Likert responses. The mean difference for four comparisons of perceived efficacy of ketorolac and lidocaine, pre- and postpublication, was assessed using the Mann-Whitney t-test with bootstrapped 95% confidence intervals (CIs), and depicted with a Cumming estimation plot using the “dabestr” package in the programming language R. The null hypothesis was explored with a factorial analysis of variance assessing differences in mean perception of lidocaine efficacy in renal colic while accounting for two factors, namely, when the survey was completed (before/after LIDOKET publication) and FOAM use. The variable FOAM was collapsed to a binary variable (yes/no) for this analysis. Given that there was no interaction effect between the two factors, the additive model was used for analysis. A sensitivity analysis was conducted to explore the impact of FOAM use as an ordinal variable. An alpha of 5% was used for significance. All statistical analyses were performed using R (GUI 1.70 El Capitan build).

RESULTS

Survey Respondents
There were a total of 472 total survey respondents. A total of 383 respondents provided prepublication and postpublication survey answers. A total of 321 physicians, or 75.7% of total respondents, provided pre- and postpublication survey answers. The remaining respondents included a combination of EMS providers, nurses, and nurse practitioners and physician assistants.

Frequency of Use and Perceived Efficacy of Different Analgesic Medications
Respondents were asked how often they incorporate IV ketorolac, lidocaine, and opioids into their analgesic pathway for patients presenting with renal colic, respectively. Results are depicted in Figure 1. There was no significant change in the use of the three analgesics before and after publication of LIDOKET and the concurrent REBEL EM blog post. A total of 346 respondents (73%) reported frequent or occasional use of opioids, with 60 (13%) reporting similar utilization of IV lidocaine and 378 (80%) frequent or occasional use of ketorolac. A total of 197 survey respondents reported using lidocaine (42%) for renal colic, of which 40% reported using it frequently or occasionally. Of the 197 who reported use of lidocaine for renal colic, 138 (70%) reported that they primarily learned about its use through FOAM or social media (Facebook or Twitter; Figure 2).

FOAM and Use of Lidocaine
Being a FOAM user was not associated with changes in mean difference in perception of lidocaine efficacy of renal colic (F = 0.127, p = 0.72). However, when the survey was taken—i.e., before or after the publication—was associated with a significant difference in perception of lidocaine in renal colic (F = 4.718, p = 0.03). The sensitivity analysis with FOAM as an ordinal variable did not change the significance of the model.

DISCUSSION

Identifying as a FOAM user did not influence the perception of the efficacy of lidocaine for treatment of renal colic more so than those of nonusers. There was no significant difference in perception of efficacy prior to LIDOKET and blog publication between platforms. There was a significant difference in the perception of efficacy of lidocaine for renal colic following publication of LIDOKET and the REBEL EM blog post, but no difference identified between users who identified as utilizing one platform exclusively. Both emDOCs Facebook users and FOAM users were equally impacted by the LIDOKET trial results.

Respondents, regardless of identifying as FOAM users or not, showed no change in the use of ketorolac, lidocaine, or opioids in treatment of renal colic pre- and postpublication. There was also no significant change in the perceived efficacy of ketorolac versus lidocaine pre- and postpublication, thus indicating that the LIDOKET trial results and REBEL EM blog did not significantly alter clinical practice.

The LIDOKET trial results did not significantly change clinical practice; however, it was associated with a change in perception of lidocaine’s efficacy. There was no significant difference between FOAM users and nonusers in this change of perception.

LIMITATIONS

Limitations to this study include the sample population. There was no direct way to assess the changes in
practice of individuals given the distribution of the survey. The study was also limited by the self-report of perception of frequency of the FOAM use, as well as self-identification as a physician, a method susceptible to corruption.

CONCLUSION

Physicians have a seemingly unlimited number of resources at their disposal. This was supported by the finding that 70% of our respondents reported using FOAM or a form of social media to access information that affects their clinical practice. No appreciable impact of FOAM resources was immediately apparent among our study population for this particular practice pattern; however, continuing medical education requires informed navigation of online resources and an understanding of how these resources impact medical decision making. Admittedly the practice of using intravenous lidocaine is not yet standard of care and has potential life-threatening consequences if not used properly. Given the risks associated with this specific practice pattern surveyed, it is not surprising that most practitioners were still reluctant to change their clinical practice, although it did increase their awareness of its efficacy.

Figure 1. Likert scale of responses for use of different analgesics for renal colic.

Figure 2. The mean difference for two comparisons are shown in the above Cumming estimation plot. The raw data are plotted on the upper axes; each mean difference is plotted on the lower axes as a bootstrap sampling distribution. Mean differences are depicted as dots; 95% CIs are indicated by the ends of the vertical error bars. A total of 5,000 bootstrap samples were taken; the CI is bias-corrected and accelerated. The p-value(s) reported are the likelihood(s) of observing the effect size(s), if the null hypothesis of zero difference is true. (A) Unpaired mean difference between ketorolac pre and ketorolac post is –0.056 (95% CI = –0.40 to 0.26). The two-sided p-value of the Mann-Whitney test is 0.32. The unpaired mean difference between lidocaine pre and lidocaine post is –0.301 (95% CI = –0.80 to 0.19). The two-sided p-value of the Mann-Whitney test is 0.15. (B) Unpaired mean difference between ketorolac pre and lidocaine pre is –2.89 (95% CI = –3.2 to –2.6), while the unpaired mean difference between ketorolac post and lidocaine post is –3.14 (95% CI = –3.7 to –2.6). The two-sided p-value for both Mann-Whitney tests is <0.001.
In the future, it would be interesting to study the effect of social media/FOAM on a variety of practice patterns, including those that are less controversial and risky, to see the influence that these platforms may have. This is the first study of its kind to evaluate the impact of FOAM on clinical practice. The unique method of coordinating FOAM distribution with traditional medical publications may provide future opportunities for measuring the impact of asynchronous medical education resources on medical practice.

References

ABSTRACT

The Accreditation Council for Graduate Medical Education (ACGME), which regulates residency and fellowship training in the United States, recently revised the minimum standards for all training programs. These standards are codified and published as the Common Program Requirements. Recent specific revisions, particularly removing the requirement ensuring protected time for core faculty, are poised to have a substantial impact on emergency medicine training programs. A group of representatives and relevant stakeholders from national emergency medicine (EM) organizations was convened to assess the potential effects of these changes on core faculty and the training of emergency physicians. We reviewed the literature and results of surveys conducted by EM organizations to examine the role of core faculty protected time. Faculty nonclinical activities contribute greatly to the academic missions of EM training programs. Protected time and reduced clinical hours allow core faculty to engage in education and research, which are two of the three core pillars of academic EM. Loss of core faculty protected time is expected to have detrimental impacts on training programs and on EM generally. We provide consensus recommendations regarding EM core faculty clinical work hour limitations to maintain protected time for educational activities and scholarship and preserve the quality of academic EM.

BACKGROUND

The Accreditation Council for Graduate Medical Education (ACGME) regulates residency and fellowship training in the United States by establishing minimum standards for accredited residency programs. The ACGME has developed, and periodically updates, the Common Program Requirements (CPRs) that apply to all ACGME accredited residencies. The CPRs...
describe basic components and expectations of residency training to ensure that all programs provide structured, safe, and high-quality clinical training and that resident physicians are adequately prepared to practice independently upon completion of their training. Historically, the ACGME has allowed individual review committees (RCs) to specify further details to the CPRs to account for specialty-specific differences in clinical practice and training environments.

In December 2016, the ACGME received feedback at its ACGME Milestones Summit that differences in milestones and subcompetencies hindered multidisciplinary collaborative efforts, especially with regard to shared tool and faculty development. As a consequence, the ACGME sought to “harmonize” specialty-specific requirements by revising the CPRs and competency-based milestones to create a set of common standards for all specialties. In the updated CPRs that took effect on July 1, 2019, the ACGME defined and listed specific requirements for core faculty. However, while the revised CPRs allowed specialty RCs discretion in determining the number of core faculty, the Review Committee for Emergency Medicine (RC-EM) and other specialty RCs were no longer able to establish requirements for core faculty protected time in this section of the CPRs.

In response to the changes in the CPRs, a task force of representatives and relevant stakeholders from national EM organizations convened in the fall of 2018 to examine the role of core faculty protected time and potential impact these policy changes would have on the specialty (Table 1).

The task force sought to assess the potential effects of these changes on core faculty and the training of emergency physicians. We reviewed relevant literature and the results of surveys conducted by national EM organizations. Together, we produced a joint policy statement endorsed by our member organizations. Individuals and organizations from multiple specialties submitted continued feedback to the ACGME regarding these changes to the CPRs. In response to this feedback, the ACGME Task Force issued a statement in September 2019. In this statement, the ACGME recognized the importance of allowing individual RCs discretion in requiring core faculty support. It also made clear that all requests for RCs to add requirements for core faculty support will follow the established ACGME process, including final approval by the ACGME Board in 2020 following an open public comment period and review. The concept of compensated academic time and unintended consequences of its removal are important for academic emergency physicians and hospital departments to understand. This paper, a unique collaborative effort of EM professional societies and organizations, discusses the implications of the 2019 ACGME CPRs changes and provides consensus recommendations regarding EM core faculty clinical hours and protected time.

### 2019 CPRS: WHAT ARE THE CHANGES?

The 2019 CPRs acknowledge the critical role that faculty play in residency programs: “Faculty are a foundational element of graduate medical education—faculty members teach residents how to care for patients.” In the prior (2017) EM program requirements, the RC-EM specified requirements for core faculty that included: “Core physician faculty members must be members of the program faculty, must be clinically active and teach, and must devote the majority of their professional efforts to the program. Core physician faculty members must not work clinically more than 28 hours per week on average, or 1344 hours per year, whichever is less.” Additional restrictions were placed on the clinical work hours of program directors (PDs) and assistant program directors (APDs). The inferred intent of these restrictions was to provide program leadership and core faculty sufficient protected time for engagement in educational activities associated with the residency program and academic productivity (e.g., scholarship).

The 2019 CPRs maintained protections for PDs and APDs but removed the requirement for EM core faculty protected time and the concomitant restrictions on core faculty clinical hours. The intent was to standardize requirements across all medical specialties, the majority of whom do not have specifically defined

### Table 1

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<th>National EM Groups Participating in the Task Force</th>
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<td>• American College of Emergency Physicians (ACEP)</td>
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<td>• American Academy of Emergency Physicians (AAEM)</td>
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<td>• AAEM Resident and Student Association (AAEM/RSA)</td>
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<td>• American Board of Emergency Medicine (ABEM)</td>
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<td>• American College of Osteopathic of Emergency Physicians (ACOEP)</td>
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<td>• American Osteopathic Board of Emergency Medicine (AOBEM)</td>
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<td>• Association of Academic Chairs of Emergency Medicine (SAEM)</td>
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<td>• American Osteopathic Board of Emergency Medicine (AOBEM)</td>
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<td>• Emergency Medicine Residents’ Association (EMRA)</td>
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<td>• Council of Residency Directors in Emergency Medicine (CORD)</td>
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<td>• Society for Academic Emergency Medicine (SAEM)</td>
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<td>• SAEM Residents and Medical Students (RAMS)</td>
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protected core faculty time. However, there are many aspects of EM that make it different than other specialties. Requirements for EM need to be considered within the clinical context of our 24/7 work environment and multiple unique challenges to our practice and training requirements.

**UNIQUE CHARACTERISTICS OF EM**

Emergency medicine faculty are required to be supervising and working in the clinical environment 24 hours a day, 7 days per week, including nights, weekends, and holidays. In contrast to many other medical specialties, all EM resident work is directly supervised in real time by attending physicians, and virtually all attending physicians in EM work clinical shifts continuously throughout the year (i.e., there is no distinction between “on-service” or “off-service” months). Because high variability among work environments, patient populations, and shift distribution (e.g., working triage, fast track, pediatric EM, or nonpeak hours or days of the week) impact variable relative value unit (RVU) generation, academic EM faculty workload is typically defined in total clinical work hours per year, and 100% of those clinical hours are consumed by direct patient care. This contrasts with other specialties, which define faculty expectations in terms of RVUs or percent Medical Group Management Association productivity, such that if sufficient clinical productivity is achieved in less than 40 hours per week, the rest of the work hours each week can be used for academic activities like education and research.

Unlike other specialties, EM also lacks protected time set aside for teaching during clinical shifts. EM never “caps,” there is no rounding, and patient volumes are ever increasing, so clinical shifts often focus on meeting immediate patient care needs, with limited time for bedside teaching. Formal didactics and all other residency education-focused endeavors (e.g., mentoring, participation in resident development or wellness activities) in EM generally occur exclusively outside of regular clinical shifts, so that participation in these educational activities must be additive to clinical work hours for the faculty and factored into workhours for residents. These educational activities also usually occur during the day, which can further exacerbate sleep deprivation for emergency physicians working evening and night shifts. Working longer shifts and more night shifts have been specifically associated with an increased risk of burnout in emergency physicians. In light of these factors, it has been suggested that the conventional 40-hour work week may not be a reasonable expectation for emergency physicians.7

The emergency department (ED) is also notable for its heavy cognitive load. This stems from various sources such as workload, multitasking, acuity of patients, interruptions, and teaching, and can lead to errors in patient care and task completion.8 Interruptions in workflow are noted to be very common in EM, ranging from approximately six to 12 interruptions an hour9–13, with EM residents also experiencing a high number of interruptions.9 The rate of interruptions is significantly higher in the ED compared with the outpatient settings or inpatient wards, and the ED features higher patient loads than these other environments as well.10,11

One of the reasons that EM requires extensive educational time outside of the clinical environment is the nature of the specialty itself. EM residents have been estimated to encounter only 47% of the Model of Clinical Practice during their clinical shifts.14 Hence, significant time and resources are needed to teach residents portions of the required curriculum that they are less likely to encounter working in the ED. Emergency physicians must have an extensive breadth of knowledge and the ability to immediately recognize and stabilize a vast array of diagnoses. Over the course of their training, residents must learn to perform not only common procedures but also rare but lifesaving interventions, like cricothyrotomy, perimortem c-section, pericardiocentesis, thoracotomy, transvenous pacing, and management of a mass casualty incident. The opportunities to develop these skills in vivo are so infrequent that, by necessity, residents must instead learn and repeatedly practice these skills in simulated settings under the guidance of experienced faculty, so that they are able to perform them successfully on only a moment’s notice once they are working independently. As such, a considerable amount of didactic time in EM is devoted to simulation and procedural skills training. A recent survey of the Society for Academic Emergency Medicine (SAEM) Simulation Academy found that simulation now comprises approximately 10% to 30% of EM residency total educational time.15

Emergency medicine also has a track record of innovation in medical education. Such innovation requires the investment of faculty time exclusively outside of clinical shifts. EM was one of the specialties to pilot the ACGME milestones, which required programs to invest in extensive core faculty development...
for successful widespread usage. EM also has led efforts to incorporate and evaluate novel modalities like flipped classroom didactics and free open-access medical education (FOAM) in graduate medical education. Developing these unconventional methods of teaching and learning, creating new educational content, building assessment tools, and appraising and curating nontraditional resources require more faculty time than delivering “canned” lectures. In addition to preparation time, many of these labor-intensive educational efforts—like the flipped classroom—also require more faculty to participate—and must be studied after implementation to ensure that they are useful. The time and effort EM faculty devote to education make a difference: many of EM’s graduate medical education innovations are adopted by other specialties’ residency programs, to the benefit of the entire spectrum of graduate medical education.

Additionally, the widespread utilization of ultrasound in EM now represents a significant added competency that has been folded into traditional EM residency education. To develop proficiency, residents must spend time working closely with faculty instructors to learn the manual skill of performing ultrasounds and also gain a basic understanding of the physics of ultrasonography and the ability to interpret images. The Society of Clinical Ultrasound Fellowships has estimated that the average ultrasound division director already devotes 288 hours annually (which translates to >6 hours per week) to ultrasound education and spends another 124 hours on quality assurance, without which both resident education and patient care would decline (V. Friedman, President, American College of Emergency Physicians, Irving, TX, letter to Thomas J. Nasca, ACGME, Chicago, IL, November 6, 2018). This time does not include their regular clinical shifts and any other educational or research activities. All of these extracurricular activities, including simulation sessions and ultrasound education, require both faculty preparation time and direct faculty involvement in teaching sessions beyond the normal clinical workload.

**CORE FACULTY CLINICAL HOUR RESTRICTIONS: A BUTTRESS FOR THE ACADEMIC EMERGENCY MEDICINE EDUCATOR**

The concept of providing salaries for faculty whose efforts are focused on educating young physicians dates back to Flexner’s report on medical training in the early 20th century. Flexner advocated for a move to salaried medical education faculty; he believed that freeing medical school faculty from reliance on clinical revenue for income would allow faculty to more fully engage in education and research. In the wake of the Flexner report, medical schools increased their complements of faculty, and salaried positions proliferated. However, over time, especially with the introduction of Medicare and the development of clinical (rather than tenure) faculty tracks, faculty salaries, and departmental budgets again were tied to revenue generated by faculty clinical practice, and faculty clinical hours began to rise (Table 2).

In the modern era of medical education, restricting core faculty clinical hours has certain drawbacks. Limiting core faculty clinical hours requires programs to have more faculty overall to fully cover their clinical needs, and in turn, this translates to extra departmental costs. Restrictions on core faculty clinical hours can also complicate faculty clinical scheduling and lead to suboptimal clinical schedules. Additionally, as program requirements for core faculty become more detailed and specific, it becomes more onerous for programs to comply with all requirements and maintain accreditation. Specific requirements also may not account for variation in the focus or character of individual programs, e.g., the differences between a university-based residency program and a community hospital–based program.

However, these costs seem to be outweighed by the benefits of limiting clinical hours for core faculty. Because departments typically generate revenue through patient care, many faculty compensation models tie compensation to clinical productivity. This may lead faculty to perceive education and scholarship as uncompensated activities; if faculty are not specifically paid for their teaching activities outside of the clinical setting, these activities are essentially pro bono work over and above regular compensated clinical duties. Thus, when faced with the choice between clinical

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**Table 2**

Benefits of Allocated Protected Time for Core Faculty

- Increased time for nonclinical educational activities
- Tangible recognition for scholarly work efforts outside of clinical responsibilities
- Time and resources to contribute to the academic mission of the department
- Increased opportunity and bandwidth to develop in-depth educational programming and/or pursue research
work that generates income or education work that does not, faculty may understandably choose clinical practice at the expense of engagement in medical education. Protected time gives core faculty time to participate in medical education without adding to their overall workload or forcing them to choose between compensated and uncompensated work. Additionally, it represents recognition that an institution values scholarly educational efforts, and that these efforts contribute to the institution’s overall goals of not only providing patient care but also training the next generation of physicians. In an editorial addressing the need for protected time for teaching, Brenner et al. noted that “In other fields where lives and safety are at high stake (e.g., aviation or certain military operations), there would be little question of either the time or other resources needed to assure minimum standards of competence. Yet chairs, program directors, and other educational leaders almost have to apologize for needing to request enough positions to account for protected teaching and program administration time.”

The educational value unit (EVU) productivity model represents an acknowledgment of the value of educational efforts and also of the time required for education that would otherwise either lengthen faculty work hours or come at the expense of clinical productivity (and, hence, faculty income). Many institutions and a range of specialties have already incorporated EVUs as part of their productivity and compensation structure. A consensus report by the Alliance for Academic Internal Medicine Education Redesign Task Force in 2007 concluded: “Although financial support should ideally be provided to all faculty for their teaching responsibilities, such support is particularly critical for the core faculty, because their extensive time with teaching and supervision of trainees clearly limits their ability to generate revenue through clinical practice or research.”

Protected time for core faculty additionally facilitates participation in faculty development activities. Since the Flexner report was published more than a century ago, there have been continued calls to modernize residency training to ensure that it is maximally effective and educational. Because of their significant engagement in medical education, core faculty need an understanding of curriculum design, learning theory, feedback, and assessment. Core faculty need protected time to participate in faculty development activities to acquire these additional nonclinical skills in order to become effective educators. Many newer and innovative didactic educational methods—like the flipped classroom model and simulation—especially require more faculty time and involvement.

As society’s collective medical knowledge continues to expand, faculty must conduct their own research to promote further progression of their field. They also must engage regularly with current literature to be able to effectively teach residents critical appraisal skills and evidence-based medicine. Education faculty who face competing demands for their limited nonclinical time may be forced to squeeze scholarship into whatever time remains after their clinical activities and required administrative duties. In one study, medical education faculty cited fragmented time to devote to scholarship, prioritization of other responsibilities (e.g., clinical or administrative duties), and competition for nonclinical time as impediments to their scholarly productivity (and specifically to education scholarship). Similarly, a consensus workshop at the Association of American Medical Colleges (AAMC) 2013 annual meeting listed time as one of the primary systemic barriers to medical educator research productivity. In contrast, having a designated faculty research director—typically with protected research time as well—was linked with increased resident publications and presentations in one systematic review.

Protected time, or compensation for teaching, has been associated with faculty retention. In a study of Harvard primary care physicians, faculty participation in a clerkship and their retention as clinical preceptors significantly increased when their stipend for involvement increased and when the stipend was directly linked to being a preceptor. Similarly, lack of institutional recognition and support for excellence in teaching has been cited as a factor in faculty attrition.

**BURNOUT AND EM**

Burnout and retention are issues of particular concern in EM, which, for years, has had unusually high rates of burnout compared with other medical specialties. Nearly half of the approximately 900,000 practicing physicians in the United States report symptoms of burnout. However, in a nationally representative sample of physicians from all specialties, adjusted for age, sex, and years since graduation from medical school, emergency physicians were at greatest risk for burnout (odds ratio [OR] = 3.18; p < 0.001), with nearly 70% reporting burnout (the mean across specialties was less than 50%).
In the American Board of Emergency Medicine (ABEM) Longitudinal Study of Emergency Physicians, one-third of emergency physician respondents reported burnout, and although involvement with clinical teaching was associated with higher career satisfaction, physicians who reported fatigue, insufficient time for personal life, or inability to attend educational conferences had lower career satisfaction and higher levels of burnout.\textsuperscript{36}

Administrative tasks outside of direct patient care not only consume physician time but also have been explicitly associated with physician burnout, which itself is linked with early retirement or reduction in clinical hours.\textsuperscript{37,38} A thematic analysis of 47 papers identified long working hours as a predictor of physician burnout.\textsuperscript{39} In a sample of academic otolaryngologists, dissatisfaction with work–personal life balance and inadequate administration time strongly predicted faculty burnout.\textsuperscript{40} Similarly, work manageability has been correlated with physician happiness.\textsuperscript{41}

**POTENTIAL IMPLICATIONS OF LOSS OF PROTECTED TIME FOR CORE FACULTY: SUMMING UP THE CONSEQUENCES**

Loss of protected time for EM core education faculty will reasonably be expected to lead to higher clinical work hours for education faculty. The work of residency education will then either add to core faculty’s heavier clinical workloads or fall on the few remaining program leadership faculty who retain (but will not gain additional) protected time in the new CPRs. As such, potential downstream effects of the loss of protected time for core faculty include decreased faculty job satisfaction and retention, fewer faculty choosing academic careers or medical educator career tracks, decreased scholarship, decreased educational innovation and scholarship, decreased faculty involvement in promoting resident wellness and supporting resident career development, and increased EM faculty burnout. Additionally, an inverse relationship between resident burnout and resident satisfaction with faculty has been demonstrated previously, so faculty burnout may, in turn, feed-forward and heighten resident burnout (Table 3).\textsuperscript{42}

These effects seem to run counter to other ACGME CPRs changes, including a new focus in 2019 on faculty and resident well-being: “The addition of expanded and more specific requirements regarding resident and faculty well-being emphasizes the need for programs and institutions to prioritize well-being and recognize that physicians are at risk for burnout and depression.” The ACGME further specifies that program and institution requirements now include, “...establishing policies and programs supporting optimal resident and faculty member well-being...”\textsuperscript{43} Of concern, physician burnout has been linked to a plethora of negative effects not only on physicians themselves but also on their patients. In a study of 77 attending and resident emergency physicians, those physicians with the highest levels of burnout were significantly more likely to report providing suboptimal care, including early patient dispositions, insufficient communication with patients and staff, excessive testing, inadequate pain management, and omission of information during patient handoffs.\textsuperscript{44} Additionally, a systematic review and meta-analysis of over 40 studies of physicians found that burnout was associated with increased odds for unsafe care, unprofessionalism, and decreased patient satisfaction, particularly in early-career physicians.\textsuperscript{45} Overlooking burnout, especially in younger physicians, has potential to cause negative impacts on an institutions’ ability to deliver high-quality patient care. Thus, physician burnout that results from loss of protected time for core faculty and a concomitant increase in workload may lead to lower quality clinical care and poorer faculty supervision of residents and may thereby represent a threat to patient safety.

In response to the ACGME CPRs changes, several EM organizations surveyed their members to ascertain the likely effects of the loss of core faculty protected time. Recently, 865 SAEM and 212 Council of Residency Directors in Emergency Medicine (CORD) members responded to a survey asking about the protected time they are allocated solely due to their core faculty status.\textsuperscript{46,47} A majority of respondents were PDs, associate PDs/APDs, or general core faculty members. Over 90% of respondents reported that the elimination of core faculty protected time would

<table>
<thead>
<tr>
<th>Table 3: Potential Lost Opportunities due to Unrestricted Clinical Hours for Core Faculty</th>
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<tbody>
<tr>
<td>- Attrition of top talent faculty otherwise interested in education due to competing opportunities</td>
</tr>
<tr>
<td>- Increased faculty dissatisfaction due to increased clinical and nonclinical demands</td>
</tr>
<tr>
<td>- Harmful effects on education of trainees and quality of care</td>
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<tr>
<td>- Loss of innovations and advancements in education research</td>
</tr>
</tbody>
</table>
negatively impact their ability to perform their jobs. On a Likert scale of 0 (representing no impact) to 10 (major negative impact), the average score for a question asking how the elimination of protected time would impact job satisfaction was 8.6. A large majority of respondents reported that there would be a very strong negative impact on their well-being and on their ability to perform their academic duties for their programs. Respondents also reported it would change “in a meaningful way” their current level of involvement in educational activities.46,47

Some of the most common qualitative themes in survey responses about loss of protected time included the negative impact on the educational program (e.g., on lectures, simulation, ultrasound, mentoring), the negative impact on faculty wellness, increasing clinical responsibilities that would leave no time to perform faculty responsibilities, and a negative impact on the recruitment and retention of academic faculty. Many respondents reported their unwillingness to continue their current positions considering these changes. In response to a question asking how likely respondents would be to change in a meaningful way their current academic involvement if protected time were eliminated, on a scale from 0 (no change) to 10 (leaving academic medicine), the mean score was 7.3.46 More than 95% of respondents reported that they considered elimination of the requirement for protected time job- or career-threatening.

Similarly, in the study of SAEM’s Simulation Academy, 89% of respondents strongly agreed that protected time was important for EM simulation-based education. The same percentage of respondents also strongly agreed that elimination of protected time would impact their ability to teach residents via simulation.15

Recently, ACEP released preliminary data on its survey of the ultrasound section members to assess the impact of changes in mandated protected time allotment. Fifty-one ultrasound-trained EM physicians responded, of whom 90.2% identified themselves as core faculty. At the time of the survey, 82.4% reported having dedicated protected time. Ninety-six percent of respondents reported that they do ultrasound scans regularly on their clinical shifts. Respondents also reported that they spend an average of 8.5 hours per week on resident ultrasound training and an average of 8.5 hours per week outside of their clinical shifts teaching residents. One-hundred percent of respondents with protected time believed that dedicated time for ultrasound training would decrease if protected time is lost. Eighty-eight percent believed that the proposed ACGME changes eliminating protected core faculty time would adversely affect their ability to teach, and 92.2% believed that the proposed ACGME changes eliminating protected core faculty time would adversely affect their overall wellness (preliminary data, ACEP internal survey of Ultrasound Section). [Corrections added on January 27, 2020, after first online publication: The reference citation “38” was deleted from the above sentence.]

Because educating EM residents and teaching procedural skills for emergency situations cannot be accomplished solely by teaching during clinical shifts, unintended consequences of the ACGME CPRs changes may include a reduction in the quality of training for EM residents. Without enforced prioritization of education and scholarship, departments and residency programs may emphasize generation of clinical revenue over investment in education; with the loss of protected time, core faculty will likely see their clinical workloads increase, precluding their participation in teaching activities. The CORD, SAEM, and ACEP survey results are a testament to the fact that loss of faculty protected time will result in the decline of training and the consequent inability of residents to achieve competency through the practice of critically important skills. As such, the ACGME CPRs changes have the potential to affect future emergency medical care: as the quality of resident training lessens, the quality of care provided by emergency physicians may decline, thereby impacting the future health care experiences and outcomes of the general public.

RECOMMENDATIONS AND POLICY IMPLICATIONS

Current ACGME EM program requirements specify that core faculty must be clinically active and substantially involved in resident education. This level of engagement is not possible when faculty work full time clinically; as such, core faculty must have protected time for their educational efforts (Table 4).

CONCLUSION

Emergency medicine is unique among medical specialties in that regular clinical shifts in the ED do not consistently allow time or offer opportunities for resident training in all necessary skills. Unlike other hospital or outpatient clinical environments, the ED’s patient volumes and acuity are both unpredictable and
Residency programs should continue to abide by the requirement that core faculty’s clinical hours “not exceed an average of 28 hours per week, or 1344 hours per year, whichever is less.”

Residency programs should adhere to the joint 2019 policy statement, “Compensated Time for Faculty Academic Administration and Teaching Involvement.”

Academic departments should adjust base clinical hours and define educational involvement and expectations for all core faculty.

Departments should employ other innovative strategies to facilitate faculty engagement in education, such as tracking, quantifying, and compensating faculty for the contributions through an educational value unit (EVU) system.

Core faculty should have some control over their clinical schedule and their clinical workload should align with didactics, faculty meetings, and faculty development.

Academic departments should seek novel sources of revenue to hire additional clinical faculty, fund protected time, and offer nonsalary support to core faculty to facilitate work-life integration.

If other methods are ineffective at maintaining minimum standards for core faculty protected time, we recommend that EM organizations develop a designation for programs that provide all core faculty with protected time that meets or exceeds the 2017 ACGME standard.

This certification would recognize certain programs’ superior commitment to education and allow residency applicants to identify those programs in which a culture of educational excellence and enhanced educational opportunities exist.

References


unlimited. The Accreditation Council for Graduate Medical Education Milestones track resident learning, knowledge, and skill development over the course of training, but residents can only improve on many emergency medicine milestones with skills training outside of the clinical arena. Thus, emergency medicine residency programs must rely on core faculty to provide this formal teaching outside of the clinical environment. Newer didactic modalities such as the flipped classroom, small group discussions, and simulation often require more faculty involvement than do traditional lectures. Resident ultrasound training, engagement in scholarship, and specific procedural skill acquisition all require faculty preparation for and participation in hands-on resident learning time outside of the clinical arena; this is only possible when emergency medicine faculty are given protected time for education and research.

Working more than 28 clinical hours per week, or 1,344 clinical hours per year, precludes sustained involvement in and substantive contributions to medical education. Additionally, excessive work hours or an unmanageable workload may precipitate burnout, which may negatively affect faculty recruitment and retention and ultimately the quality of emergency medicine residency training and future patient care; the unique nature of emergency medicine clinical practice may further heighten these effects. Protected time and reduced clinical hours are essential to allowing emergency medicine core education faculty to engage in education and research, without which academic emergency medicine would stagnate and residency programs could not function. Thus, emergency medicine core faculty must continue to have clinical work hour limitations and protected time for educational activities and scholarship.

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Stress Testing the Resuscitation Room: Latent Threats to Patient Safety Identified During Interprofessional In Situ Simulation in a Canadian Academic Emergency Department

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ABSTRACT

Objectives: Emergency department (ED) resuscitation is a complex, high-stakes procedure where positive outcomes depend on effective interactions between the health care team, the patient, and the environment. Resuscitation teams work in dynamic environments and strive to ensure the timely delivery of necessary treatments, equipment, and skill sets when required. However, systemic failures in this environment cannot always be adequately anticipated, which exposes patients to opportunities for harm.

Methods: As part of a new interprofessional education and quality improvement initiative, this prospective, observational study sought to characterize latent safety threats (LSTs) identified during the delivery of in situ, simulated resuscitations in our ED. In situ simulation (ISS) sessions were delivered on a monthly basis in the EDs at each campus of a large tertiary care academic hospital system, during which a variety of scenarios were run with teams of ED health care professionals. LSTs were identified by simulation facilitators and participants during the case and debriefing and then grouped thematically for analysis.

Results: During the study period, 22 ISS sessions were delivered, involving 58 cases and reaching 383 ED health care professionals. 196 latent safety threats were identified through these sessions (mean = 3.4 LSTs per case) of which 110 were determined to be “actionable” at a system level. LSTs identified included system/environmental design flaws, equipment problems, failures in department processes, and knowledge/skill gaps. Corrective mechanisms were initiated in 85% of actionable cases.

Conclusions: Effective quality improvement and continuing education programs are essential to translate these findings into more resilient patient care. ISS, beyond its role as a training tool for developing intrinsic and crisis resource management skills, can be effectively used to identify system issues in the ED that could expose critically ill patients to harm.

Emergency department (ED) resuscitations are complex, dynamic interactions involving a diverse team of health care professionals (e.g., nurses, physicians, respiratory therapists, patient care aides) directed at the rapid stabilization, diagnostic workup, and treatment of critically ill patients before transfer for ongoing or
definitive care. For medical teams working in this high-stakes context, tightly coordinated and interdependent action is essential to ensure patient safety and optimize outcomes.\(^1\) However, effective performance in this environment is threatened by the ad hoc nature of the teams brought together, knowledge and skill gaps among individual team members, breakdowns in communication, and design flaws in the system and working environment.\(^2\)–\(^4\) Each of these challenges, in turn, risks exposing the patient to medical error, morbidity, and adverse outcomes. At the very least, these challenges threaten to thwart our efforts in delivering high-quality care.

Simulation-based education (SBE) is a training modality that uses sophisticated mannequins and other techniques (e.g., task trainers, trained actors) to replicate clinical encounters, providing the opportunity for clinicians to develop competency in high-stakes clinical skills in a safe environment.\(^5\) SBE is particularly well suited to high-acuity cases where opportunities for deliberate practice are limited\(^6\) and has been shown to be an effective training method for medical trainees in diverse specialties,\(^7\) as well as for interprofessional education.\(^8\) The aim of such programs is to develop proficiency in crisis resource management (CRM)—both the technical (i.e., clinical, procedural) and the intrinsic (i.e., interpersonal, teamworking) skills necessary for effective navigation of a medical crisis.\(^9\) Traditionally, SBE has been delivered in a laboratory or theatre setting, mocked up to resemble the clinical environment.

A more contemporary use of simulation is its application in the real patient care environment (a.k.a., “in situ simulation” [ISS]) as a means to heighten realism, relevance, and retention among simulation participants\(^10,11\) while bringing together groups of health care professionals that work together day to day as clinical teams. ISS has been proposed as a means to engage practicing health care professionals in interprofessional team training and offers an opportunity for on-the-job education.\(^12\) Further, ISS creates opportunities to integrate SBE within the broader health care system, as a tool for optimizing patient care and safety.\(^13\) In settings outside the ED resuscitation environment, such ISS interventions have been shown to enhance technical performance, reinforce team behaviors, and improve objective clinical outcomes, especially in the context of cardiac arrest and trauma resuscitation.\(^14\)–\(^16\)

In situ simulation has also been proposed as a mechanism to identify latent safety threats (LSTs) in the clinical environment. In a systems-centered approach to understanding patient safety in health care,\(^17\) errors are recognized as generally being attributable to misalignments between the individual(s), equipment, and working environment rather than a fault on the part of individual health care practitioners alone—the “Swiss Cheese Model” of failure pioneered by Reason.\(^17\) Through this system lens, LSTs are recognized as significant modifiable threats to patient safety or quality of care that result from challenges with equipment, processes, training, or other system breakdowns that typically lie dormant.\(^18\) These unrecognized risks embedded within clinical systems are usually only elucidated under stressed conditions when existing defenses or workaround processes within the organization fail. ISS can therefore play a critical role, where SBE is implemented in the real clinical environment with the real clinical team that is working, using real medications and equipment to discover LSTs without risking harm to a patient.\(^19\) Examples of LSTs include cultural barriers to effective teamwork, flaws in the design of working environments and/or equipment, issues with maintenance or upkeep of systems, and training or knowledge gaps among clinical staff. When such threats are unmasked during a crisis, they can interfere with effective team functioning or safe and timely delivery of care and can ultimately lead to patients suffering harm—through delays, misdiagnosis, or more grievous errors.

Research on this topic to date has been largely focused on operating room, inpatient, and pediatric contexts,\(^20\)–\(^24\) where the literature has demonstrated that ISSs can be effective tools for imparting the necessary stress to a health care system to effectively unmask LSTs before a real patient encounter. Limited examples in the domains of pediatric emergency medicine and trauma resuscitation have shown similar results,\(^25,26\) but to date little published evidence exists for its use in adult emergency medicine.\(^27\) In this paper we report on the use of an ISS program in our tertiary care academic ED for detecting LSTs.

**METHODS**

We prospectively evaluated the impact of an ED-based interprofessional ISS program on the identification of LSTs at our institution from January 2015 to December 2016. A needs assessment was conducted through
consultation with departmental leadership, nurse educators, and simulation faculty and from incident reviews, patient safety reports, and morbidity and mortality rounds. From this needs assessment, we developed our curriculum, teaching model, and selected cases relevant to the resuscitation environment. The research protocol was approved by the institutional research ethics board.

We delivered ISS sessions in 4-hour blocks, once per month in the EDs at two campuses of an academic tertiary care hospital system and regional referral center for trauma, cardiovascular and cardiac arrest, stroke, cancer, and critical care in Ottawa, Canada (combined patient volume ~180,000 visits/year). On each date, three teams of on-shift ED staff (typically attending physician, emergency medicine resident, medical student, nurses, respiratory therapist, patient care assistant) were recruited on a voluntary basis to participate in an approximately 45-minute simulation session. Informed consent was obtained for participation in the study.

A resuscitation bay in each ED was allocated for a 4-hour period at the discretion of the charge nurse on duty that day. The charge nurse also maintained discretion to cancel simulation sessions if department pressures were too great. Four-hour blocks were identified to maximize efficient use of resources (i.e., simulation technologists, equipment, facilitators, clinical space) and timed to coincide with historically lower-volume periods to minimize impact on departmental flow and crowding. Funding was allocated from the departmental academic budget to provide physician educators and from institutional nursing education budgets to staff additional nurses for the 4-hour period. The supplementary staff allowed for flexibility among the on-shift ED team to leave assignments for the sake of participation. The explicit objectives of the sessions were to:

1. Enhance the use of CRM, specifically: situational awareness, closed-loop communication, summarizing, task assignment, leadership, and followership;
2. Practice the management of critical incidents in the clinical setting; and
3. Identify latent threats to quality and safety in the clinical environment.

Each session followed a standard structure: a 5-minute scripted prebriefing on confidentiality, the goals of this session (both team training and system audit), and an orientation to the simulation mannequin (Data Supplement S1, Appendix S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10422/full); a 15-minute simulated medical resuscitation scenario using a high-fidelity mannequin (SimMan 3G) or standardized patient, depending on case; a 20-minute facilitated debriefing following the PEARLS framework to address both technical and intrinsic skill performance of the team; and 5 minutes for session feedback from participants. Cases were selected from our local emergency medicine simulation case bank of over 50 previously developed clinical scenarios, with slight adaptations (e.g., to narrative or procedural needs) made at facilitator discretion to optimize educational value for all members of the interprofessional team. Real clinical equipment was used, and this waste was considered acceptable from an operational and budgetary perspective by department leadership. An experienced nurse-confederate was involved in each case and responsible for maintaining "boundaries" of the simulation—for example, blood bank activation would lead to a simulated "massive transfusion box" made available and the blood bank not actually contacted (rather, a mock phone call was made by the confederate). Emergency physician faculty members active in the departmental simulation program and experienced in debriefing oversaw delivery of cases and codebriefed the interprofessional teams with the full-time nurse educator at each campus. The debriefing focused on highlighting success, closing performance gaps, and meeting the session objectives including CRM principles and the discovery of LSTs.

Data Collection and Analysis

At each simulation session, a nurse research assistant with experience in emergency medicine and simulation-based medical education was present to assist with recruitment of participants, collection of consent and feedback forms, and LST documentation. LSTs were identified primarily by simulation participants and facilitators, either during the case or during the debriefing, and were recorded by the research assistant on a standardized data collection form (Data Supplement S1, Appendix S2). The research assistant was also responsible for capturing subjective quotes relevant to the curriculum objectives. The case facilitators (nurse educator and simulation faculty member) reviewed the compiled list of LSTs identified at the end of each case to ensure that no items were missed based on their own observations. Participants
completed a standardized, anonymous feedback form (Data Supplement S1, Appendix S3) rating their experience participating in the simulation, reactions to the case, any LSTs they had identified, reflections on their own learning, and feedback on the program. Data were then entered into a master spreadsheet (Microsoft Excel, 2011) and grouped thematically by two authors (GM and CP) for analysis. Due to the qualitative, exploratory nature of this study, only descriptive statistics were calculated. A report was generated at the end of each 4-hour session summarizing the LSTs identified (example in Data Supplement S1, Appendix S4); this report was circulated to key stakeholders including nursing and departmental leadership, unit managers, nurse educators, and the departmental clinical practice, quality, and safety committee to develop and implement mitigation strategies for the LSTs identified.

RESULTS

Over our 2-year intervention period we successfully delivered 22 simulation sessions between two campuses, comprising 58 simulated resuscitations on a range of clinical topics (Table 1) and reaching 383 total ED health care professionals (Table 2). Only one planned simulation session was canceled due to departmental overcrowding and high patient volume. Cases and participant demographics are described in Tables 1 and 2, respectively.

During these sessions we identified and reported on 196 LSTs—yielding an average of 8.9 (95% confidence interval [CI] = 7.7 to 10.1) LSTs identified per session and 3.4 (95% CI = 3.1 to 3.7) per case. These findings included safety threats attributable to system/environmental design flaws, equipment problems, failures in department processes, and knowledge/skill gaps (Figure 1).

System design flaws identified issues with physical space and ergonomics of the resuscitation room working environment. Examples of safety threats in this domain included the physical locations of medication and cardiac arrest carts (outside the room, necessitating that team members needed to leave the case frequently with subsequent degradation in situational awareness), organization of equipment carts (making it difficult to locate needed equipment in a timely fashion), latency in the hospital paging system when calling for help from consultants, and the absence of a labeling/ID system to identify various team members.


<table>
<thead>
<tr>
<th>Case</th>
<th>No.</th>
</tr>
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<tbody>
<tr>
<td>Septic shock</td>
<td>7</td>
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<tr>
<td>Unstable trauma</td>
<td>7</td>
</tr>
<tr>
<td>Pediatric cardiac arrest</td>
<td>7</td>
</tr>
<tr>
<td>Unstable bradyarrythmia</td>
<td>7</td>
</tr>
<tr>
<td>Pediatric sepsis</td>
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<tr>
<td>Excited delirium</td>
<td>3</td>
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<tr>
<td>Acute myocardial infarction</td>
<td>3</td>
</tr>
<tr>
<td>Pulseless electrical activity arrest</td>
<td>3</td>
</tr>
<tr>
<td>Massive gastrointestinal bleed</td>
<td>4</td>
</tr>
<tr>
<td>Rapid atrial fibrillation</td>
<td>2</td>
</tr>
<tr>
<td>Acute stroke</td>
<td>1</td>
</tr>
<tr>
<td>Ventricular fibrillation</td>
<td>4</td>
</tr>
<tr>
<td>Challenging an authority figure</td>
<td>1</td>
</tr>
<tr>
<td>Peri-mortem cesarean section</td>
<td>2</td>
</tr>
<tr>
<td>Crashing congestive heart failure</td>
<td>3</td>
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ISS = in situ simulation.

<table>
<thead>
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<tr>
<td>Physicians</td>
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<td>Respiratory therapists</td>
<td>45</td>
</tr>
<tr>
<td>Patient care aides and other</td>
<td>23</td>
</tr>
</tbody>
</table>

ISS = in situ simulation.

Figure 1. Proportions of LSTs identified by category. LST = latent safety threat.
in a busy environment. Process failures pertained to medication administration errors, difficulties in accessing or applying clinical protocols, handover deficiencies, and issues with hospital-level activations (e.g., massive transfusion protocol, trauma team activation). Equipment threats identified unrecognized problems with specific equipment required to deliver effective resuscitative care—such as defective parts in several laryngoscopes or expended batteries in a transvenous pacemaker generator as well as restocking issues for some frequently used devices (e.g., sterile ultrasound probe sheath covers, PEEP valves).

The remainder of the LSTs—comprising half of all those identified—were categorized as “knowledge/skill gaps”; that is, breakdowns in team functioning attributable to gaps or deficiencies in technical or intrinsic skills within the team. These gaps were further subcategorized by type, including breakdowns in team situational awareness, loss of team “shared mental model,” errors in the performance of clinical procedures, errors of omission, and inappropriate action taken for the clinical problem. Examples are provided in Table 3.

Of the 196 LSTs identified, 110 (56%) were found to be “actionable” at a systemic level. For example:

- Layout of physical spaces and equipment carts has been through several revisions, informed by the findings of the ISS program;
- Restocking problems have been addressed with supply managers;
- Medication references and infusion charts have been better itemized with binders made more accessible to staff; and
- Education campaigns were disseminated to address recurring knowledge gaps.

In the study period, 93 of the actionable LSTs (85%) have been addressed through process improvement, system change, or enhanced education efforts. The remainder of LSTs generally pertained to individual knowledge gaps and teamwork breakdowns that were addressed explicitly during the debriefing.

**DISCUSSION**

In this study, implementation of a system-integrated, longitudinal ISS program allowed us to identify a high prevalence of LSTs in an academic tertiary hospital ED environment. The nature of tertiary care emergency medicine dictates that teams rarely work together on more than one occasion, training and skill levels are heterogeneous, and working environments are often organized by accretion rather than through detailed planning, testing, and revision. While resuscitation in the ED is common, in a large department such as ours it represents an example of “high acuity, low opportunity” for individual health care professionals, limiting opportunities to identify targets for individual, team, or system improvement. Moreover, in a busy ED environment, dedicated time for debriefing is rarely forthcoming. Without such time, dangers or problems encountered (and usually mitigated) during major cases are often dismissed or forgotten about by staff who must urgently turn their attention to the next patient, rather than engaging in the cumbersome process of reflection and subsequent system change.

As such, ISS in our setting has been an effective tool in creating dedicated opportunities and time for interprofessional ED teams to train and improve together: fostering increased understanding of concepts in CRM while simultaneously providing a forum to reflect on and identify latent threats to patient safety that need attention. In the course of running the ISS program, a recurring theme reported by staff was that many identified LSTs had “always been an issue”—suggesting that they accepted a status quo and learned mitigation strategies rather than reporting on the issues or advocating for change, which aligns with the vast body of literature on system failures and LSTs. This program has thus proven useful not only in

<table>
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<tr>
<th>Knowledge/Skill Gap</th>
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<tr>
<td>Team situational awareness</td>
<td>Delayed recognition of changes in patient condition</td>
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<tr>
<td>Team “shared mental model”</td>
<td>Communication breakdowns, misunderstanding of clinical problems by members of the team</td>
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<td>Incorrect performance of clinical procedures</td>
<td>Poor CPR quality, Incorrect administration of fluids/drugs, difficulties using intraosseous infusion lines</td>
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<td>Errors of omission</td>
<td>Failure to use established protocols, ignoring airway compromise</td>
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<td>Inappropriate action for the clinical problem</td>
<td>Inappropriate medications given, CPR not started when necessary</td>
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identifying LSTs, but in advancing a culture of patient safety, disseminating knowledge among our group of health care professionals on the influence of human factors and system design in medical error, and promoting the value of addressing identified problems “upstream.” This has been reflected repeatedly in both formal and informal feedback from participants stating that “we need to do this more often,” that “these sessions are extremely important,” and that they have “more confidence speaking up if they saw an issue” with the medical care or working environment. A cornerstone of the success for our program has been an adept and responsive group of managers and leaders interested in supporting the program delivery with operating funds and an eagerness to act on closing LST gaps emerging from the ISS program.

Interestingly, while our methodology followed a model similar to that of Patterson et al. in combining participant and facilitator observations to identify LSTs, we identified LSTs at a much higher frequency than that in studies by either Patterson et al. or Couto et al. We favored the approach of Patterson et al. to LST identification as it allowed for a perspective from the front-line team, where LSTs are likely often quietly mitigated by the team during the case and only raised after, in the debrief. In contrast to the study by Patterson et al., where a hard 10-minute cap was used for both scenario delivery and debriefing, we allowed our cases to run longer and allotted more time for a fulsome debrief. Our experienced facilitators endeavored to allow a free-flowing dialogue by the participants, with an organic identification of LSTs, although they also raised their observations in the discussion. In combination, these differences in technique may have allowed more time for participants to reflect on and relay the range of LSTs encountered.

A particular highlight of our program is its success despite the busy and chaotic environment of a tertiary care, urban academic ED. Hypothetically “unannounced” simulations might have been more naturalistic and could have elucidated LSTs during stressed operating conditions. However, this is extraordinarily challenging to accomplish in the ED where overcrowding, irregular and unpredictable arrivals of critically ill patients, and high patient volumes are commonplace. To facilitate the delivery of these sessions, careful planning and coordination with on-shift leadership was necessary. Despite these factors, our program was able to run with high engagement and a very low cancellation rate. As such, our article perhaps illustrates the pragmatism necessary to balance the priorities of idealized human factors testing against real-world operational issues that challenge feasibility.

LIMITATIONS

Our study has other limitations. First, as a single-institution trial in a Canadian academic ED, the findings may not be generalizable to other centers, particularly smaller hospitals and those in countries with different health care delivery models. Second, this study was bolstered by tremendous institutional buy-in, enabling us to run ISS sessions with little resistance from leadership or front-line staff despite occasional personnel shortages and ED overcrowding. Third, our timing of the simulations to coincide with lower-volume periods in the ED, chosen for convenience and to minimize the probability of cancellation, may have led to underreporting of LSTs related to stressors encountered during high-volume times. Fourth, this study relied on self-identification of LSTs by health care professionals involved in the cases and as such could have missed LSTs that might have been detected by, for example, formal human factors analysis. Fourth, as an observational study, we cannot objectively demonstrate that ISS improved LST detection, and it is possible that other patient safety interventions or QA processes could have had a similar effect on detection and subsequent mitigation. Similarly, our study set out explicitly to find LSTs, and our system-integrated approach to case selection meant that in some instances we deliberately set out to impart stress, through the cases selected, on areas of suspected vulnerability; as such, our findings suffer from confirmation bias in influencing the identification of LSTs by team members. Finally, and importantly, the detection and reporting of LSTs has not been shown in any simulation-based study to definitively improve upon real patient-oriented outcomes (e.g., process improvements leading to objectively more efficient/effective care, morbidity and mortality, changes in departmental safety issue reporting rates), so while intuitively the increased interception of LSTs should improve clinical care, more work needs to be done to justify the considerable investment of time and resources into such a program.

CONCLUSION

We found that in our tertiary care, academic EDs, in situ simulation has been effective as a “stress test”
of staff, space, and systems, revealing a high frequency of actionable latent gaps that endanger safe patient care. Further research is still required to understand if the actionable changes in fact decrease the frequency of latent safety threats occurring in real clinical care and whether this modality is more efficient in uncovering latent safety threats and linking these to improved patient outcomes. Our findings add to the growing body of evidence that in situ simulation can be used as a tool to enhance quality and improve the care ED teams are able to provide for their sickest patients.

References


Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10422/full
Emergency Medicine Gender in Resident Leadership Study (EM GIRLS): The Gender Distribution Among Chief Residents

Alexandra Mannix, MD¹, Melissa Parsons, MD¹, Sara M. Krzyzaniak, MD², Lauren Page Black, MD, MPH¹, Al’ai Alvarez, MD³, Shivani Mody, DO, MSEd⁴, and Michael Gottlieb, MD⁵

ABSTRACT

Objectives: The goal of this research was to determine the gender distribution of chief residents in emergency medicine (EM) residencies in the United States to explore whether the gender leadership gap is present at the resident level in EM.

Methods: The investigators compiled a list of EM residency programs accredited by the Accreditation Council for Graduate Medical Education. Investigators reached out to the programs using established best practices in survey distribution collecting the following: program name, program location, program length, total number of residents, total number of female residents, total number of chief residents, and the total number of female chief residents.

Results: Of the 223 programs contacted 194 programs responded and 182 programs were included in the study (a response rate of 82%). As of the 2019 to 2020 academic year, female EM residents account for 37.0% (2,459/6,718) of all EM residents and female EM chief residents account for 42.2% (250/593) of EM chief residents. The proportion of female EM chief residents was significantly higher than the proportion of both female EM residents (42.2% vs. 37%, p = 0.007) and female EM attending physicians (42.2% vs. 27.5%, p < 0.001). When comparing proportions of female residents based on duration of program, female physicians comprised 35.0% (1,652/4,720) of residents at 3-year programs and 40.4% (807/1998) of residents at 4-year programs (p < 0.01).

Conclusions: While the proportion of female EM residents remains significantly lower than the proportion of male residents, females and males are similarly represented at the chief resident role.

Gender disparities exist in medicine. Factors such as implicit bias may lead to challenges in female physicians obtaining leadership positions in academia and hospital administration. Efforts to increase female representation in medicine in the United States have been effective, with women comprising at least 40% of all medical school matriculants for almost 30 years.¹ As of 2017, there were more female (50.7%) than male medical students matriculating in U.S. medical schools.² Similarly in U.S. EM residencies, female representation has seen an upward trend, comprising 33.6% in 2018,³ up from 25.5% in 2013⁴ according

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[Corrections added on March 10, 2020 after first online publication: “Acknowledgment” section has been added]

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to the Association of American Medical Colleges (AAMC) data.

While gender composition in medical school has reached parity and female representation in EM residencies continue to increase, the increased representation of women at the undergraduate and graduate medical education levels has not yet closed the gap gender in female faculty promotion and leadership appointments.

Beyond residency training, women make up 32% of associate professors, 20% of full professors, 14% of department chairs, and 11% of deans at U.S. medical schools. Similarly, female physicians are underrepresented among residency program directors in the 10 largest specialties albeit a trend up in EM. There is a dearth of literature around gender representation in the chief resident role in any specialty including EM. The goal of this research was to determine the gender distribution of chief residents in EM residencies in the United States to better understand overall gender leadership gap in academic medicine.

**METHODS**

**Study Design**

We performed an observational survey study regarding female EM residents and EM chief residents in the United States. We compiled a list on December 11, 2018, of all EM residency programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) according to their website. A data extraction tool was developed to identify and categorize program-level data. The following information was collected: program name, program location, region, program length, and primary type of residency (i.e., allopathic or osteopathic). The tool was piloted independently by three investigators. This study was granted an exemption by the institutional review board from the parent institution.

**Study Population**

All ACGME-accredited EM programs from the ACGME website were included in the study population.

**Study Protocol**

Between May 23, 2019, and August 9, 2019, investigators reached out to the programs using established best practices in survey distribution. Programs were contacted a minimum of three times with no more than one e-mail per week. Program leaders (i.e., chair, program directors, and assistant/associate program directors) were contacted to obtain the information. If no response was obtained after three e-mails, investigators reached out to other available program contacts (e.g., program coordinator, other faculty members). If there was still no response or no further contacts were available, the program was excluded from the study.

**Outcome Measurements**

Our e-mail survey collected the following information: total number of residents, total number of female residents, total number of chief residents, and the total number of female chief residents. National data regarding the number of female attending physicians and resident physicians were obtained from the open access AAMC.

**Data Analysis**

Categorical variables were summarized using counts and percentages and analyzed using Pearson’s chi-square tests. We used program reported data for comparisons of proportions of female residents and female chief residents by length of training program. The AAMC data were used for comparisons of female residents to national demographics for female EM attending physicians.

**RESULTS**

Of the 223 programs contacted, 194 programs responded. Of those, 11 programs did not have chief residents, and one program declined to participate, for an overall response rate of 182/223 programs (82% response rate). Of the included 182 programs, data regarding the total number of residents, total number of female residents, total number of chief residents, and the total number of female chief residents were available from all of the programs.

Across EM residency programs, we found that the average number of all EM residents is 36.6 residents per program and the average number of female EM residents is 13.8 residents per program. Additionally, we found that the average number of all EM chief residents is 3.2 per program and the average number of female EM chief residents is 1.4 per program.

As of the 2019 to 2020 academic year, female EM residents account for 37.0% (2,459/6,718) of current EM residents and female EM chief residents account for 42.2% (250/593) of current EM chief residents in
our study sample. Compared to the proportion of female EM attending physicians at 27.5% (11,658/42,315) there are significantly more female EM residents (27.5% vs 37.0%, \( p < 0.001 \)). The proportion of female EM chief residents was also significantly higher than the proportion of both female EM residents (42.2% vs 37.0%, \( p = 0.007 \)) and female EM attending physicians (42.2% vs 27.5%, \( p < 0.001 \)).

The data were then separated into 3-year versus 4-year programs to see if there were differences in gender representation. The percentage of female EM residents was significantly higher in 4-year (807/1,998, 40.4%) programs compared to 3-year (1,652/4,720, 35.0%) programs (\( p < 0.01 \)). There were no significant differences in the proportion of female EM chief residents in 4-year programs (72/151, 47.7%) compared to 3-year programs (178/442, 40.3%, \( p = 0.11 \)).

**DISCUSSION**

Our study finds that female residents are represented at a rate that is slightly higher than the percentage of females in U.S. EM residency programs. Chief residents are considered to be resident leaders, and the position is often regarded as a stepping stone into an academic career. The increased numbers of female chief residents across the country may help influence leadership roles in future careers and may even help close the well-established leadership gap in academic EM in the future.

Emergency medicine is continuing to increase the percentage of female physicians in the field. As of 2017, the AAMC calculated that 35.5% of EM residents were female; however, our data suggest an even higher percentage (37%) in the 2019 to 2020 academic year. Our data suggest that in the past decade, we have seen an increase in the percentage of female chief residents.12

The factors contributing to the variation in distribution of female residents according to training duration remains unclear. However our study shows that females have increased representation in 4-year programs. Efforts should be made to explore why 4-year programs have more female residents to improve representation across all programs.

**LIMITATIONS**

It is important to consider several limitations with respect to this study. First, gender is nonbinary and self-determined. While it would have been preferable to ask each individual resident to self-identify their gender, this was not feasible due to limited contact and concerns regarding response rate. Consequently, it is possible that our results may not reflect an individual’s gender identity in select cases. Additionally, while we followed best practices and attempted to obtain information from all programs, we were only able to obtain responses from 82% of programs. While there remained 18% of programs that we were unable to obtain information on gender distribution of residents and chief residents, we believe that this is unlikely to significantly alter the findings of this study.

Further, this study only included ACGME-affiliated resident programs and may not reflect the distribution among non-ACGME programs. Another limitation is the lack of information regarding EM chief resident qualifications (e.g., publications, oral presentations, national leadership positions, in-training examination scores), which may impact chief resident selection. Finally, this study was only conducted among EM residency programs and may not reflect the gender distribution in other fields.

**CONCLUSION**

The study determined the gender distribution of chief residents in emergency medicine residencies in the United States to be similar between male and female residents. While the proportion of female residents remains significantly lower than the proportion of male residents, females and males are similarly represented at the chief resident role. Female chief residents are represented at a higher than expected ratio when compared to the total number of female EM residents.

**References**

3. Table B3: Number of Active Residents, by Type of Medical School, GME Specialty, and Sex | AAMC. AAMC. Available at: https://www.aamc.org/data-reports/students-residents/interactive-data/table-b3-number-active-residents-type-medical-school-gme-specialty-and-sex. Accessed September 23, 2019.


Virtual Remote Attending Supervision in an Academic Emergency Department During the COVID-19 Pandemic

Walter A. Schrading, MD, David Pigott, MD, and Linda Thompson, MD

NEED FOR INNOVATION

As the surge of COVID-19 patients increased, our academic university faculty needed to explore ways to protect the more vulnerable physicians in the group from infection while maintaining the service to our patients and the educational objectives of our residency training program.

BACKGROUND

In December 2019, a novel coronavirus (SARS-CoV-2) was identified in Wuhan, China. The disease caused by this virus, COVID-19, typically presents with a viral prodrome that may subsequently progress to severe pneumonia and has been associated with significant morbidity and mortality in those most affected. This novel pathogen has since spread widely and is now the cause of a global pandemic and likely represents the greatest global health crisis since the 1918 Spanish influenza pandemic. Approximately 20% of COVID-19 cases progress to severe disease. The case fatality rate (CFR) varies widely across the globe but has a median of approximately 2% to 3% and has been directly associated with increasing age. In the United States, the CFR is 0.1% to 0.2% for those less than 45 years of age, with dramatic increases starting in the 55- to 64-year age group whose fatality rates are 1.4% to 2.6%. The CFR is as high as 27.3% for those > 85 years.

Although multiple treatments for COVID-19 are currently under investigation, none have yet been definitively identified as either effective or protective. While many health care professionals can move to telemedicine or telephonic modes of patient care or simply cancel office visits and elective procedures, those involved in essential patient care activities involving COVID-19 patients may not have this ability. Emergency physicians are on the front lines caring for these patients and thus risk exposing themselves to the disease. Reports from across the globe have warned of dangerous shortages of personal protective equipment (PPE) that is necessary to prevent health care providers from becoming infected. Despite precautions, hundreds of health care providers have already died of COVID-19. Because of the increased risk of morbidity and mortality for older physicians and the immunocompromised, a number of emergency physician groups have taken measures to decrease the risk of COVID-19 exposure for these health care professionals. A recent informal Twitter poll revealed a variety of institutional and departmental policies aimed at protecting the most vulnerable medical personnel. Many excluded physicians who are older than 60 to 65 years, immunocompromised, or pregnant from contact with suspected COVID-19 patients. Some kept...
physicians older than 50 out of higher risk aerosolizing procedures, such as endotracheal intubation. Since the beginning of the pandemic, the younger faculty at our institution, the University of Alabama at Birmingham, have volunteered to perform all aerosolizing procedures and intubations in lieu of the more vulnerable physicians.

**OBJECTIVE OF INNOVATION**

Our objective is to allow the use of telemedicine resources to decrease physician exposure to SARS-CoV-2 and decrease risk of morbidity and mortality for the most at-risk attending physician group while maintaining appropriate emergency medicine (EM) resident supervision, training, and teaching. We also endeavor to maintain excellence in bedside patient evaluation and care.

**DEVELOPMENT PROCESS**

As preparations were being made for a surge of COVID-19 patients in April 2020, a more formal strategy was instituted at our facility. A vulnerable group of physicians (N = 7) who are > 59 years or immunocompromised were assigned to a novel telemedicine shift, which allows the attending physician to remotely supervise the resident directly involved with patient care. Our site is a 1,100-bed university hospital with a fully accredited, 3-year ACGME EM residency training program with a total of 32 residents and over 40 faculty.

University of Alabama at Birmingham has invested in telemedicine since 2017 and during the pandemic, our ED started an aggressive plan to utilize the telemedicine carts to evaluate patients remotely, with the primary goal of protecting vulnerable faculty from exposure, while also decreasing the use of PPE. With these goals in mind, we implemented a novel use of the telemedicine carts to allow an attending physician to be in a remote location while still providing care to ED patients and supervising residents.

**IMPLEMENTATION**

In our university ED, the staffing model provides full-time triple attending physician coverage, with one attending physician covering one of three resident pods. This level of physician staffing permits the replacement of one physically present attending with a remote attending in one of the pods. The remote physician-staffed pod is also covered by a senior EM resident and is in a central location, which allows the physically present attending to be immediately available for any critically ill patients or to assist with the performance of a necessary procedure if needed. These remote shifts are staffed by the vulnerable attending group. If needed, these could also be covered remotely by an attending infected with COVID-19 who is well enough to work a shift from home but not yet beyond the recovery period allowing return to physical work. In this model, the attending physician works from home and can sign the electronic medical record (EMR) remotely, as well as access all information available to the resident on shift. Figure 1 shows one author and the telemedicine cart. The attending can control camera motion and a robust zoom lens to allow for closer inspection of physical examination findings. Conversations with residents regarding patient care may occur “face to face” on the video monitor or by telephone.

When a new patient arrives in the pod, the resident takes the telemedicine cart (with the embedded telemedicine attending) into the patient room. This process allows the attending to observe the entire initial history, physical examination, and assessment and ask additional questions. Formal case presentation is often
not necessary given the participation of the telemedicine physician in the initial patient assessment. The resident and attending can create a patient management plan together; can view electrocardiogramss, radiography, and laboratory results; and plan patient disposition.

**OUTCOMES**

There are several benefits we, as remote attendings, have discovered during this process. One is the ability to observe the entirety of the resident’s interaction with the patient. As academic physicians, we often do not have this opportunity unless we make specific efforts to do so. We can also observe and participate in the discussion of the plan with the patient at the end of the initial assessment. To be able to provide constructive feedback on this less commonly observed skill is useful. We are also able to review the patient’s chart in real time as the resident is gathering patient information. This interaction provides valuable insight into the resident’s thought process.

To assure that this process was functional and continuing to meet the needs of our residents, we conducted an informal survey of those remotely supervised. The vast majority (85%) of the residents agreed that the remote attending was able to supervise patient care and provide appropriate resident feedback, which allow them to continue to progress in their training. Seventy-three percent agreed that it was easy to communicate with the remote attending. The residents, however, were split on the question of whether having the remote attending in the room while they perform the initial assessment allowed them to learn during this process. They all agreed that the remote attendings were dedicated to teaching and supporting their education.

This telemedicine remote process has some drawbacks. While the overall audio quality is good, it can be difficult to hear conversations that take place in loud environments or farther from the telemedicine cart. We also feel more distant and detached from our fellow attendings who are staffing other patient care areas. Communication is limited to the telemedicine cart or to the telephone. From a practical perspective, we cannot directly supervise procedures because we would not be able to provide physical directive advice or correction. When a procedure becomes necessary, one of the two physically present attendings provides the resident supervision and the note is sent to that attending for countersignature.

**REFLECTIVE DISCUSSION**

We describe a novel approach to telemedicine that came out of the desire of our academic faculty to protect the more vulnerable in the group from exposure to COVID-19. While we understand that it is not as optimal as in-person supervision, it appears to be a viable method to provide resident supervision in an academic EM residency program during this difficult time. Although there are some drawbacks, we have also discovered some advantages in this mode of supervision. We feel that we can provide appropriate resident supervision, teaching, and feedback. However, to truly measure the feasibility of this modality, a more formal study would be warranted, including a carefully designed, validated survey instrument. This could be evaluated in the future. We are thankful to be a part of such a large and compassionate academic faculty that allows us the opportunity to continue to be an active part of residency education and patient care while respecting the increased risks to our own health. Like many innovations that have occurred in a short period of time during the COVID-19 pandemic, we hope that this option might be useful to other academic programs or community hospital physician groups who may have an at-risk group of physicians.

The authors thank Erik Hess, MD, Interim Chair; Blayke Gibson, MD, Medical Director; and the academic faculty of the University of Alabama at Birmingham for their unwavering support, heroism, and dedication during these uncertain times. The authors also thank Eric Wallace, MD, Director of Telemedicine, for his leadership in disseminating this technology.

**References**


Emergency Medicine Residency Curricular Innovations: Creating a Virtual Emergency Medicine Didactic Conference

Jason Rotoli, MD, Ryan Bodkin, MD, Joseph Pereira, DO, David Adler, MD, Valerie Lou, MD, Jessica Moriarty, Jennifer Williams, and Flavia Nobay, MD

ABSTRACT
Currently, there is a pandemic forcing social distancing and, consequently, traditional in-person education must shift to a virtual curriculum to protect all parties and continue professional development. Recognizing that not all emergency medicine (EM) content can be taught through a virtual platform, we propose a model for nearly all EM resident didactic conference adaptation to a virtual format to meet the needs of the adult learner while protecting all participants from the current coronavirus pandemic.

NEED FOR INNOVATION
Curricular change is prompted by content evolution, generational learning preferences, technological advances, and environmental factors such as the current pandemic. Current recommendations for social distancing require an urgent shift of nearly all in-person emergency medicine (EM) didactic conference to a virtual platform while maintaining rigorous standards and engaging faculty and learners.

BACKGROUND
Medical education must continuously evolve to meet the needs of adult learners and have flexibility to be delivered in a variety of settings. Regardless of the environment, an innovative EM curriculum must engage learners and foster professional development while meeting Residency Review Committee/Accreditation Council for Graduate Medical Education (RRC/ACGME) standards.

OBJECTIVE OF INNOVATION
Our goal is to provide a guide for adaptation of nearly all in-person EM education to an online learning platform that is concordant with ACGME standards, acknowledges the psychosocial impact of decreasing in-person contact, and fosters continued resident and faculty engagement.
DEVELOPMENT PROCESS

Given that the content for our EM curriculum was already developed, in this section we describe the adaptation process of shifting to a virtual format. With drastic changes in the educational environment, participants may feel overwhelmed regarding the ability to learn or teach.\textsuperscript{18–20} To educate participants (residents and faculty) on the upcoming changes, our program implemented the following steps:

- Developed an asynchronous tutorial for Zoom instruction (including steps to operate the virtual classroom) and made real-time training available for all participants.
- Designed an online color-coded schedule (outlining the expected date/time of upcoming changes) allowing participants to prepare for curricular format and content changes (see Table 1).
- Adjusted the conference evaluation to gather feedback regarding content and technology alignment.
- Recognized technology inaccessibility (e.g., computer or Wi-Fi access) for some users and designated available office space.
- Conducted a virtual Q&A session for residents and faculty prior to implementation to review the process, communicate expectations, and validate participants’ stress.

Prior to COVID-19, our weekly conference included up to 5 hours of 15-, 30-, or 45-minute didactics; hands-on sessions; and small-group activities. Additionally, we incorporated a procedural curriculum in cadaver lab for one faculty and three to four residents per week after conference. Prior to shifting to a virtual curriculum, it was essential to assess applicability of each of the previously utilized didactic formats to an online platform. We performed a brief literature review of virtual education, Knowles’ continuum of pedagogy and andragogy, Mayer’s 12 principles of multimedia learning, Brookfield’s overview of experiential and self-directed learning, and the impact of COVID-19 and social isolation.\textsuperscript{2–5,10–13,21–25} Based on residency leadership experience in curricular innovation and the literature review, we established a consensus for which didactic formats would be feasible in a virtual format.

THE IMPLEMENTATION PHASE

The curriculum has four didactic formats: 1) faculty-moderated virtual large group sessions, 2) faculty and chief resident-moderated virtual small-group sessions, 3) independent (asynchronous) learning activities, and 4) limited in-person critical procedure labs. Using the Zoom platform, large-group sessions consisted of approximately 40 learners and two or more faculty. One faculty member presented EM core content while another moderated questions in the chat function. The moderator also shared relevant articles or multimedia learning materials to augment the presentation. This format also allowed for inclusion of national speakers. Additionally, the large-group format was used for board review where residents were divided into one of four “virtual teams.” They answered questions through an online response system and individual

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<td>8:00 – 8:30</td>
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<td>Residency Leadership</td>
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<tr>
<td>8:30 – 9:00</td>
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<td>Resident Briefing on Mock Orals*</td>
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<td>CORE: Pediatric Upper Gastrointestinal Bleeding*</td>
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<td>Update: e-Oral board exam*</td>
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<td>10:00 – 11:00</td>
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<td>Coaching and Debrief session: Effects of COVID-19*</td>
<td>Dr. D, Department of Psychiatry</td>
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<td>R1 Foundations—Toxicology*</td>
<td>EM Faculty Small group</td>
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<td>11:00 – 1:00</td>
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<td>Resident A, B, C, D</td>
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R1 = resident year 1; R2 = resident year 2; R3 = resident year 3; ALIEM = Academic Life in Emergency Medicine.
*Zoom format.
†Independent learning.
‡In person.

Table 1
Sample Weekly EM Resident Didactic Schedule (University of Rochester, Department of Emergency Medicine)
scores contributed to an annual team total. These sessions encouraged team learning, supported resident and faculty interaction, and fostered a sense of community aimed at simulating an in-person setting.16,26 The large-group format was conducive to sharing the rapidly changing COVID-19 institutional policies. We also included optional debriefings with a mental health professional during conference time.4

Additionally, the small-group format offered a more targeted experience with emphasis on team learning, resident interaction, and connection with faculty.26 Examples included case-based learning, journal clubs, and one-on-one oral board practice with a faculty member. We set up Zoom breakout rooms allowing us to better engage individuals. For example, residency administration created breakout rooms including a chief resident and at least one faculty member with a group of 12 to 15 residents for a challenging ethical case discussion. Using the same breakout room model for oral board practice, residents were paired on a rotating basis with one of six faculty members who conducted six concurrent one-on-one cases. During the cases, faculty intermittently shared a screen that displayed relevant information (e.g., labs, imaging). Subsequently, the breakout rooms allowed for private debriefings to emphasize the learner’s strengths and areas for improvement.

Independent learning activities were critical for successful virtual conference implementation as they emphasized flexibility, allowing learners to work at their own pace and focus on knowledge gaps.27,28 The activities consisted of multimodal content that included oversight with dashboards and testing functions allowing leadership to hold residents accountable.9,29,30 Examples included Academic Life in EM, Foundations of EM, and Rosh Review Journal Club.

Finally, it was necessary to continue critical procedural education (such as airway management in COVID patients) in person through cadaver lab while emphasizing safety with daily online symptom screening, social distancing, limited size (three to four residents and one faculty), and appropriate PPE.

EVALUATION

This article presents a roadmap for conference adaptation with preliminary feedback that provides a window into the success of our conference adaptations to COVID; however, there was no evaluation of knowledge learned or skills gained through a postintervention evaluation. Through an anonymous REDCap survey, we gathered weekly faculty and resident feedback related to content, delivery, and use of technology.31 We had a total of 41 residents with varying numbers of faculty each week. Over the first 6 weeks, we had a mean resident response rate of 94.6% (range = 93%–100%). Of the 208 total virtual conference–related comments, 199 of 208 (95.6%) were positive.

In reviewing the preliminary resident and faculty feedback, the following themes emerged:

- The initial Q&A session was critical to outline the process.
- Participants appreciated the investment in change and were forgiving of glitches in implementation.
- The debriefing sessions were helpful to reduce stress.
- Participants were interested in continuing virtual conference even when social distancing is no longer required.
- Residents felt that faculty were accessible, invested, and engaged.

REFLECTIVE DISCUSSION

During the implementation process, several lessons regarding technology integration, content adaptation, and faculty development were learned. Regarding technology, aligning conference needs with the functionality and limitations of the virtual platform was imperative. For example, we initially struggled with appropriate screen sharing, mute functionality, and document sharing in a large group setting. Test runs of the chosen platform helped to avoid future technical issues.

With regard to content adaptation, we recognized that all EM education cannot be taught online. Subsequently, it was important to continuously review which content was conducive to online delivery. Also, a variable format was critical to maximize participant engagement without magnifying the cognitive fatigue and disconnect that occurs with online learning.17,27,32 Based on feedback, we adjusted the duration of certain didactics (e.g., board review, journal club) as some required more time given the need for audience participation in a virtual setting. Finally, it was crucial to acknowledge the psychosocial impact of virtual
learning and current pandemic by providing recurring updated pandemic-related content and debriefing time within conference.

For faculty development, we recognized early on that all presenters were familiar with Zoom as a meeting tool; however, the vast majority were uncomfortable using Zoom as a teaching tool. Consequently, we created a tutorial and offered real-time training with a superuser who was available by e-mail, phone, or video chat (Zoom) to troubleshoot issues.

As a backup plan for unforeseen issues with technology, we created a bank of alternate content. We pooled asynchronous content from FOAMed resources (e.g., Academic Life in EM, Foundations in EM, JETem), provided residents with access to question banks, and recommended other streaming content. Programs with limited personnel/resources for technologic advancement should appoint a single lead to become proficient in the use of online education platforms while using some of the aforementioned resources as a temporary bridge.

Our model is applicable in other institutions that have adequate access to technology and financial/administrative support for virtual platform integration. This model can be used with faculty or senior residents leading the small-group discussions and case-based learning. The independent learning content is also easily modifiable and applicable in other settings.

Expanding educational delivery beyond the physical classroom by shifting didactic conference to a virtual platform has diversified the way we teach. Additionally, participants viewed the new format positively. With early program leadership engagement, we developed innovative ways to virtually educate learners while acknowledging participant stress in the face of drastic change. Future investigation is needed to objectively assess the educational impact of a virtual EM conference format.

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A Novel Medical Student Assistant Accommodation Model for a Medical Student With a Disability During a Required Clinical Clerkship

Joshua Jauregui, MD¹, Jared Strote, MD, MS¹, Conrad Addison, MD², Lynne Robins, PhD³, and Jamie Shandro, MD, MPH¹

ABSTRACT

Background: As efforts continue to diversify the physician workforce so that it better matches the patient population, the number of medical students with disabilities will increase. U.S. medical schools and emergency medicine (EM) clerkships should be prepared to provide full and meaningful access to learners with disabilities.

Methods: We created a novel means of providing access to a senior medical student with a mobility disability (secondary to a cervical spinal cord injury) to participate in a fourth-year EM clerkship. We hired four second-year medical students as intermediaries to perform senior medical student-directed physical examination maneuvers, during his 15 required 8-hour emergency department shifts. The senior medical student dictated his documentation using Dragon Natural Speaking (Nuance Communications, 2015) voice recognition software.

Results: The senior medical student successfully completed the required clinical clerkship and earned a honors grade for his work. Both the senior medical student and the second-year medical student intermediaries gave positive feedback about the experience.

Conclusions: Given the significant prevalence of disability among medical students in U.S. medical schools, medical educators should provide greater access to students with disabilities and opportunities for advanced education for all learners by creating innovative clinical curriculum. The authors recommend the student intermediary model for senior medical students with physical disabilities in required clinical clerkships.

The prevalence of disability among medical students in U.S. medical schools is significant, with percentages ranging from 2.7% to 12% of all students.¹⁻⁴ However, this prevalence is likely even higher due to underreporting.⁵ Furthermore, there has been a recent increase in attention to the disparity in prevalence of disabilities between U.S. physicians and the general population. Nineteen percent of Americans identify as a person with a disability and recent research demonstrates that patient outcomes likely improve from an increase in physician–patient concordance similar to those with concordance in other marginalized populations.⁶⁻¹¹ As efforts to improve the diversity of the physician workforce to better reflect the patient population and decrease health care disparities among underrepresented populations continue, the number of medical students with disabilities will increase and so too must U.S. medical schools’ and
emergency medicine (EM) clerkships’ ability to provide meaningful, equal access to learners with disabilities.\textsuperscript{12–14} We define disability, in accordance with the American with Disabilities Act (ADA), as a physical or mental impairment that substantially limits one or more of the major life activities of such individuals, a record of such an impairment, or being regarded as having such an impairment.\textsuperscript{15} The barriers that students with disability face are many and complex, including physical, structural, attitudinal, and behavioral.\textsuperscript{1,16} The ADA requires schools to reasonably accommodate the disabilities of their students unless doing so would fundamentally alter a program or result in undue hardship.\textsuperscript{1} However, a recent Academic Medicine document analysis of all U.S. medical schools’ technical standards found that only 33\% of schools stated a willingness to provide accommodations, while the remaining schools published ambiguous (49\%), unsupportive (5\%), or no language (14\%) about providing them.\textsuperscript{3} Additionally, of the schools with available information regarding intermediaries, most (84\%–86\%) proscribed against intermediaries.\textsuperscript{3} Judicially, several recent court leanings found in favor of the defendant, upholding the school’s responsibility to afford qualified medical students with disabilities reasonable accommodations to ensure equal access to a program.\textsuperscript{17–19}

We enrolled an undergraduate senior medical student, with a physical disability, in a 4-week required EM clerkship from August to September in the 2017 to 2018 academic year. Although published undergraduate medical education curricula exist addressing patients with disabilities, we are unaware of an EM clerkship curricular innovation for medical students with physical disabilities available in the literature to date.\textsuperscript{20}

**DEVELOPMENT AND IMPLEMENTATION**

The clerkship directors engaged in an interactive process\textsuperscript{1} as the guiding framework to create a novel accommodation experience for a senior medical student with a mobility impairment secondary to a cervical spinal cord injury to participate in a fourth-year EM clerkship. This process began with an individual meeting with the senior medical student and the clerkship directors to discuss the daily routine for students on the clerkship and the access needed to perform the essential elements of the clerkship, such as accommodations to navigate the physical environment and to perform necessary physical examination maneuvers, documentation, and procedures. The senior medical student and the clerkship directors subsequently visited the ED to identify specific workspace barriers, including computer access and access to patient rooms.

After this preliminary needs assessment, the senior medical student and the clerkship directors met with a working group of representatives from the School of Medicine Student Affairs Office, the Disability Resources for Students Office, and the Curriculum Office. This group identified other necessary accommodations, including a voice recognition software that the senior medical student was familiar with. The group also determined that the optimal manner to meet the clinical requirements (fifteen 8-hour emergency department [ED] shifts) was to provide an intermediary to the senior medical student. The group then drafted an intermediary job description (see Data Supplement S1, available as supporting information in the online version of this paper, which is available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10426/full). The clerkship directors reviewed the drafted responsibilities for the intermediary role with the senior medical student, confirming that he was in agreement. The position would report to the Disability Resources for Students Office staff and the EM clerkship faculty. The School of Medicine, via the Disability Resources for Students Office, funded the intermediaries’ wages at $17/hour. The local minimum wage at that time was $15/hour. Together, with the group of representatives above, the clerkship directors determined that the provision of access required for the student to participate in the clerkship would not impose an undue administrative, financial, or other hardship to the EM clerkship or the School of Medicine.

The clerkship directors chose to have second-year medical students serve as intermediaries. Second-year medical students at our school have completed 1 year of “Foundations of Clinical Medicine,” which encompasses the foundations of clinical skills, as well as a longitudinal primary care practicum, which includes a weekly primary care clinic where they see patients with preceptors. Thus, they have familiarity with medical terminology as well as clinical medicine and have had proctored experience with medical interviewing and physical examination skills. In addition, this opportunity has the added benefit of learning for the second-
year medical students. Health care professionals who encounter persons with disabilities often have more progressive attitude toward them than those who do not.21 As such, having the second-year medical students act as intermediaries allows them to work alongside a peer who identifies as having a disability, creating a space for these future physician to learn about, and potentially erode, any stereotypes that they may have about persons with disabilities.

The intermediary position was posted at our institution, and second-year medical students were encouraged to apply via group e-mails. Four intermediaries were hired for the role, all of whom had previously sought out shadowing opportunities in the ED and thus had additional familiarity with this clinical and educational environment. The clerkship directors decided on this number of intermediaries to maximize continuity for the senior medical student while minimizing time demands for the active second-year students. We will henceforth refer to the second-year medical students hired as intermediaries only as “intermediaries,” rather than “medical students,” for clarity purposes.

The clerkship directors met with the senior medical student along with all four intermediaries to orient all parties to the objectives of the clerkship and the roles and responsibilities of the intermediaries and to answer any questions. During this time, it was clarified that the role of the intermediaries was to assist the senior medical student and that they should be mindful to avoid extraneous comments during shifts and to save clinical questions for after the shift.

Scheduling
The clerkship directors considered the intermediaries’ own class schedule when making the schedule for our senior medical student and avoided overlap with class hours as much as possible. They divided the 15 shifts for the senior medical student among the four intermediaries, assigning each three or four shifts over the 4 weeks. All shifts were in a single university teaching hospital’s ED.

Shift Setup
Intermediaries met the senior medical student at the beginning of each shift and accompanied the student throughout the shift. They assisted with computer sign-in and station setup as needed, retrieved printed documentation from the printer, and accompanied the senior medical student on all patient care tasks.

History and Physical Examination
The intermediary accompanied the senior medical student to see all patients and assisted as needed with opening doors or moving gurneys. The senior medical student introduced himself and the intermediary and asked all history questions. For the physical examination, the senior medical student directed the intermediary to perform physical examination maneuvers, and the intermediary verbally reported all findings.

Documentation
The clerkship directors require students to write a note on each patient they care for during their EM rotation. At the time of this curricular innovation, clerkship directors required all students to type their notes into a Microsoft Word document on a secure computer in the ED and then delete them after printing for supervising physician review. The senior medical student used Dragon Natural Speaking (Nuance Communications) voice recognition software to dictate notes into Microsoft Word, and then the intermediary printed the documents out and handed them directly to the supervising physician for review.

Procedures
The senior medical student had previously met competency in specific procedures prior to their injury (laceration repair, IV placement, incision and drainage of an abscess). Therefore, the clerkship directors did not ask him to repeat these procedures during the EM rotation. The student was able to discuss in detail the indications for specific procedures on patients who needed them and read required supplemental material for each procedure.

Assistant Communication
The intermediaries developed a confidential group document to constantly share lessons learned for making shifts run well, to keep track of the schedule, and to stay in communication.

OUTCOMES
We evaluated the experience in three ways: 1) We assessed the student’s clinical performance. 2) We assessed the senior medical student’s perception of access in the rotation, and 3) we assessed the second-year medical students’ experience serving as intermediaries. The metrics for evaluation used to give the senior medical student this grade were the same
metrics used for all students rotating in the clerkship. The senior medical student earned an honors grade for his advanced clinical management skills. Historically, only 25% of students rotating in our EM clerkship earn a honors grade. Comments from his evaluation include:

“He did an extraordinary job on our shift together, seeing far more patients than most students usually see in a shift. He charted immediately and efficiently, keeping up with charting while taking ownership for the care of his patients. He was thorough and knowledgeable while also being open to feedback and learning.”

"Focused, emergency appropriate clinical reporting (pertinent positives ± negatives sorted appropriately), used clinical decision rules (PERC). Worked well with RNs."

"Excellent student with broad foundation of knowledge and communication skills. Some of the best presentations I’ve heard. Great job updating family and patients."

Unstructured qualitative feedback about the experience from the senior medical student was extremely positive. We did not wish to compromise the rotation and evaluation experience for him by formally studying his experience while he was being evaluated academically, so we opted to interview him at the close of the rotation after we had submitted his grade. He reported meeting all learning objectives without significant difficulty and recognized the value of the voice recognition software, which he described as efficient and effective. Furthermore, he continued to apply the intermediary model developed during his EM rotation the following year during his internship with rotating medical students at his new institution.

We interviewed all the intermediaries following the clerkship. They were also positive about their experience, reporting that it provided invaluable clinical exposure and prepared them for future clinical rotations.

REFLECTIVE DISCUSSION

Lessons Learned
Transferability of this model to other institutions may be limited by resources and the timing of specific clerkship experiences. Providing equal access for the EM rotation necessitated funding for intermediaries, minor administrative support, and an estimated 8 hours of additional faculty time. This did not constitute an undue hardship for our program or our school. However, because determination of undue hardship is based on the individual nature and cost of an accommodation, as well as the structure and resources of an individual institution, less-resourced schools may need to consider other reasonable accommodations beyond our intermediary model. Structurally, our EM clerkship is well-timed as it occurs in the fourth year, after the senior medical student had completed all other required clerkships save for neurology. This made it possible for us to confirm that he was competent in skills-based requirements. It may be worth exploring, however, which skill-based requirements for medical students with disabilities are necessary if they are destined for specialties that will not involve the medical school–required skill.

Next Steps
We present a model for accommodating students with physical disabilities in the clinical environment, pairing second-year medical students with a senior medical student. The model has the potential to be used in other clerkships, in residency programs, and in practice. It also has potential to expand our ability to increase diversity in medical education and practice to better reflect the diversity within our patient population. In addition, this model has the added benefit of breaking down stereotypes our students and/or faculty may have about persons, including patients and/or colleagues, with disabilities. Involving learners with disabilities in the education of learners without disabilities adds valuable insights about providing patient-centered care and access to persons with disabilities. Further experience and study should examine the extent of disabilities for which such a program would work and how to construct systems that support successful access on a broader scale.

The authors thank Alexis Rush and Kristen Seiler in their essential administrative and collaborative contributions to make this innovation a success.

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19. Dean v University at Buffalo School of Medicine and Biomedical Sciences, 804 F3d 178 (2d Cir 2015).


Supporting Information

The following supporting information is available in the online version of this paper available at http://onlinelibrary.wiley.com/doi/10.1002/aet2.10426/full

Data Supplement S1. Clinical assistant job description.
Remote Learning in the Time of COVID-19

With the spread of SARS-CoV-2 in the United States, medical schools across the nation have taken measures to protect the health and safety of their students. Notably, most schools have elected to suspend clinical experiences for medical students as the pandemic evolves. Many schools have demonstrated creativity and adaptability by developing online, non-clinical electives for their students to engage in. Here, we provide an easily implemented opportunity for remote clinical learning in the time of COVID-19 in the emergency department.

REMOTE LEARNING PROCESS

This process affords students the opportunity to practice history taking, differential diagnosis, clinical reasoning, and patient management skills from a remote setting (Figure 1). A student will be assigned to a resident or attending and will be available by cell phone, tablet, or other communication device when that physician is working. The resident or attending will contact the student prior to the shift and set a time period when a patient will be identified for the student to interview. Ideally, the student will also have remote access to the electronic medical record for chart review. Low-volume or fast-track shifts likely will be most amenable to this scheme.

During the session, the student performs iterative differential diagnosis formulation, as described in other medical education schemes. The Clinical Reasoning and Differential Diagnosis Sheet (Figure 2) is a helpful tool to guide clinical reasoning. Figure 3 demonstrates a completed version based on a remote learning case regarding a 45-year-old healthy male

![Figure 1. Remote learning instructions.](image-url)

The authors have no relevant financial information or potential conflicts to disclose.
presenting with 2 weeks of lower back pain with bilateral sciatica after an episode of heavy lifting and with a recent history of rollover motor vehicle collision.

At the end of the remote session, the physician and student should review concepts learned during the session and provide feedback. Assessment and teaching of clinical reasoning can be integrated into the case presentation through clinician verbalization of their own thought process.²

CONCLUSION

As the pandemic continues to evolve, identifying and implementing opportunities to provide some form of
clinical continuity and education for medical school learners will be of high value. This simple scheme provides for real-world case practice from a remote setting in the current (and likely recurrent) event that learners are not permitted in the direct clinical environment. In a time demanding adaptability and creativity, we believe this process offers a reasonable model of clinical learning and a valuable engagement for learners.

Table 3. Example of a completed Clinical Reasoning and Differential Diagnosis Worksheet.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Findings supporting</th>
<th>Findings opposing</th>
<th>Findings that would be expected but not seen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis 1:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disc herniation</td>
<td>- History of trauma</td>
<td>- Report of possible paresthesia in saddle region</td>
<td>- Expected findings were observed</td>
</tr>
<tr>
<td></td>
<td>- Pain worse with physical activity and sitting down</td>
<td>- Bilateral symptoms less common</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Sciatica; straight and cross-leg tests positive bilaterally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis 2:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fracture</td>
<td>- History of trauma</td>
<td>- Lack of point tenderness</td>
<td>- Point tenderness over spinous process</td>
</tr>
<tr>
<td></td>
<td>- Pain worse with physical activity</td>
<td></td>
<td>- History of steroid use</td>
</tr>
<tr>
<td>Diagnosis 3:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cauda Equina</td>
<td>- Lower back pain and bilateral lower extremity sciatica</td>
<td>- Normal neuro exam</td>
<td>- Bowel/bladder incontinence or retention</td>
</tr>
<tr>
<td></td>
<td>- Report of possible paresthesia in saddle region</td>
<td>- Subacute course</td>
<td>- Saddle anesthesia</td>
</tr>
<tr>
<td>Diagnosis 4:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epidural Abscess</td>
<td>- Lower back pain and bilateral lower extremity sciatica</td>
<td>- Afebrile</td>
<td>- Fever, point tenderness</td>
</tr>
<tr>
<td></td>
<td>- Normal neuro exam</td>
<td></td>
<td>- History of intravenous drug abuse, diabetes, signs of distal infection, or immunocompromise</td>
</tr>
<tr>
<td>Diagnosis 5:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aortic Dissection</td>
<td>- Age</td>
<td>- Normal neuro exam</td>
<td>- History of hypertension, connective tissue disease</td>
</tr>
<tr>
<td></td>
<td>- History of trauma</td>
<td>- Normal cardiovascular exam</td>
<td>- Pulse, blood pressure differences in extremities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ask faculty for feedback (i.e., strengths, areas for improvement) – focused on “serious” causes of back pain which are important to rule out; work on also identifying more of the most common causes.

What is one concept you learned? These patients benefit from early multi-modal pain control including an NSAID, acetaminophen, and a muscle relaxant.

What might you do differently next time? I need to remember to ask for/perform a full lower extremity neuro exam for these patients including reflexes and thorough sensory exam.

References


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In Crisis: Medical Students in the COVID-19 Pandemic

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The coronavirus (COVID-19) pandemic has sent shock waves through the house of medicine, generating uncertainty, fear, and questions about the role of the medical student during the times of public health crises. On March 17, 2020, the Association of American Medical Colleges, in a joint statement with the Liaison Committee on Medical Education (LCME), recommended that medical schools adopt at least a “two-week suspension on their medical students’ participation in any activities that involve patient contact . . . [to allow time] to develop appropriate educational strategies and alternative clinical experiences to best assure safe, meaningful clinical learning for students.”1 While this article focuses on the impact of such a statement on medical students rotating through the emergency department (ED), many of the concepts and strategies detailed herein also apply more broadly to medical students in any clinical environment.

Historical Context
The historical record provides two pertinent examples of how a pandemic can impact medical students. In the first example from the 1918 Spanish influenza epidemic, medical students were asked to replace physicians lost to infection and deployed to areas in need across Spain.2 As the disease spread to the United States, the Secretary of the Minnesota State Board of Health collaborated with the dean of the University of Minnesota Medical School to recruit senior medical students to fill the void closer to home.3 Similarly, in Philadelphia, third- and fourth-year students from the University of Pennsylvania School of Medicine staffed an emergency hospital with minimal to no supervision, after receiving a single lecture on the disease.4 These examples represent an aggressive expansion of responsibility for medical students in a time of crisis.

In contrast to the critical role of medical students providing direct patient care, more recently in 2003 during the severe acute respiratory syndrome (SARS) outbreak, medical student exposure to patients was sharply curtailed. That year, the Faculty of Medicine at the Chinese University of Hong Kong suspended clinical teaching of medical students after 17 students contracted the SARS coronavirus from an index patient while on the wards.5 Similarly, the University of Toronto restricted clinical activity for their medical students during the same outbreak.6

Prior to the AAMC recommendations, the decision of whether medical students should continue clinical work remained controversial and varied. Public health advisors to the government in both the United Kingdom and Canada have suggested engaging medical students in the workforce to combat COVID-197 as was deemed necessary in 1918. In Italy, one of the countries most profoundly impacted by the COVID-19 pandemic, medical students have already been “promoted” early.7,8 The government has waived their
standard qualifying examinations and will bypass their standard 8- to 9-month graduation and credentialing process, resulting in about 10,000 medical school graduates joining the existing Italian physician workforce in clinics and retirement homes.8

Medical education leaders may benefit from studying the different approaches used globally to inform approaches at their own sites. This article presents perspectives of a panel of local undergraduate and graduate medical education experts, residents, and medical students regarding the benefits and risks associated with medical student clinical involvement during a pandemic and provides potential alternatives to augment students’ contributions and education while minimizing undue risk.

**BENEFITS OF STUDENT INVOLVEMENT IN CLINICAL EXPERIENCES**

**True Value of the Educational Experience and Future Practice Patterns**

A valuable emergency medicine (EM) clerkship requires more than the simple presence of students in the ED.9 Active contribution to patient care enhances medical student learning.10 Students report feeling ill-prepared for residency with shadowing-only experiences that do not allow for clinical decision-making practice and express a desire for active involvement.11,12 The phenomenon of “scutwork,” defined as the “non-clinical yet essential tasks that do not require a doctor’s degree or expertise” also impacts the student’s experience.13 Although the traditional definition of scutwork mainly refers to nonclinical tasks, the definition is subjective and can also refer to service-related clinical tasks traditionally outsourced to other ancillary staff, such as transporting patients to the radiology suite. Nonetheless, limiting hands-on, direct patient care may naturally increase the amount of scutwork performed by medical students.

In general, excessive time devoted to scutwork contributes to trainee burnout without significantly enhancing education.14 Student contribution to the team, however, enhances a sense of importance which in turn further improves student contribution.15 Components of traditional scutwork may still represent value-added activities, especially during an international emergency that impacts the standard balance of student education and patient care.16

Pandemics and other critical incidents may offer valuable and relatively rare educational experiences to learners. The informal but practical curriculum of ethics, policy development, and resource allocation are critical points of learning for providers.17,18 Such crises may increase in frequency with emerging infectious diseases and natural disasters on the rise.19,20 Today’s trainees may face another pandemic, or similar crises, in their career as practicing EM physicians. First-hand knowledge of the current system’s response to threats such as COVID-19 can increase the awareness of systemic problems. In turn, this may inspire trainees to spearhead future disaster-preparedness, public health, and related endeavors in local and national arenas.

**The Student–Medical School Financial Agreement**

In the event of a pandemic, suspending student clinical experiences without replacement activities for a prolonged period may result in extended student enrollment time or lost vacation time or threaten enrollment eligibility entirely. When students enroll in medical school, they assume considerable financial burden and risk by delaying or abandoning full- and part-time work to completely devote themselves to 4 years of expensive training. An unanticipated suspension could jeopardize student eligibility for loans and financial aid, increase the amount borrowed, lengthen the time period over which money is borrowed, or some combination of these.

**Residency Applications and Preparedness**

An interruption to medical student education could have lasting effects on trainee competitiveness for residency applications and preparedness for intern year. Many EM applicants rotate through their home or away EDs during their late third year and early fourth year, the timing of which has coincided directly with the COVID-19 pandemic. The EM application process all but requires that students have performed their home rotation and received letters from one or two additional away rotations. A suspension or loss of home or away EM rotations could have a major impact on student schedules and application competitiveness and deprive students of the chance to evaluate residency programs of interest. Not surprisingly, this can only lead to increased confusion, frustration, and anxiety for students. While the Council of Residency Directors in Emergency Medicine (CORD) Advising Students Committee in Emergency Medicine (ASC-EM) has already begun the hard work of addressing the downstream effects of canceled away rotations on
residency applicants, note that this is still effort and time diverted from other important, student-centric tasks.\textsuperscript{21}

Should medical students be removed from clinical duties, those students nearing the end of their training may not complete required clerkships in time, including EM rotations at many schools. These students risk delayed graduation or substandard preparation for their next year as an intern, the downstream effects of which residency programs will have to overcome.

Medical Students’ Professional Identities

The physician’s professional identity, which Wilson et al.\textsuperscript{22} have defined as “how a doctor thinks of himself or herself as a doctor,” begins in earnest in medical education. The typical, non–COVID-charged medical school rotation allows the student to develop a professional identity through contribution to patient care, argued by some as the only way to do so.\textsuperscript{15}

When we consider that one’s professional identity is intricately connected to wellness and professional relationships with teammates, peers, and patients, the significance of its development grows.\textsuperscript{23} The clinical experience fosters such development in a variety of ways.

Contributing to patient care results in a sense of ownership and responsibility to and for patients, perhaps most deeply felt when mistakes are made.\textsuperscript{15} Additionally, those mistakes can highlight the importance of one’s professional reputation.\textsuperscript{15} Direct patient care also fosters a realization of expectations, limits, and privileges as the student compares his or her own abilities to that of a resident or attending on the team.\textsuperscript{15,24} That team, and the student’s active role on it, serves to illustrate the medical student’s importance and perception of such.\textsuperscript{15} Furthermore, in the times of crisis, contributing to patient care may provide an enhanced sense of satisfaction and purpose. In that sense, the loss of the clinical experience is more palpably felt. Additionally, releasing students from their clinical duties at a time of crisis could signal the perception that they are more learners than they are members of the health care team. This is not entirely unreasonable but should be considered.

Medical school administrations intentionally and appropriately message to students that they are an asset to the health care team, but as the AAMC pauses students’ clinical experiences, students may be questioning the legitimacy of these claims. A teaching hospital remains such even when under duress. That said, higher patient volumes, new COVID-19–related protocols, and other crisis-specific issues may limit faculty members’ practical ability to teach. Continued, if modified, clinical experiences accommodate these constraints and may preserve students’ sense of belonging and importance. There are subtle lessons and values imparted on our medical students when we continue or suspend their clinical experiences.

Medicine as Service

The Hippocratic oath embodies the promise that today’s physician “... will remember that [he or she] remain[s] a member of society, with special obligations to all [his or her] fellow human beings.”\textsuperscript{25} This idea of “special obligations,” of the same cloth from which the sentiment of a “noble profession” is cut, speaks to a sense of duty experienced by physicians that exceeds that of the typical employee. Indeed, society tends to hold the medical profession in such great esteem because of high professional and ethical standards and the physician’s commitment to patients.\textsuperscript{26}

As with soldiers in battle, a call to action may eclipse training restrictions—otherwise known as a “field promotion.” Losing members of the health care team to quarantine or illness increases the need for health care personnel. Italy responded to this very problem with accelerated graduation for senior medical students who can now practice as general practitioners against COVID-19.\textsuperscript{8} When asked to “step up to the plate,” medical trainees may feel more prepared if they have remained on the frontlines up to that point. In this regard, students may advocate for a choice in the matter. Before the world saw influenza H1N1, more than half of students surveyed at University of Alberta believed that medical students have an obligation to be involved in influenza pandemics.\textsuperscript{27} When surveyed at University of Michigan in the aftermath of the H1N1 pandemic, 88% students preferred to be formally involved.\textsuperscript{28} Naturally, these students may have feelings of frustration and isolation when instructed to go home.

RISKS OF STUDENT INVOLVEMENT IN CLINICAL EXPERIENCES

Transmission of Disease

Consider the notion of “flattening the curve.” This refers to the concept of spreading the incidence of a disease across a longer period of time to avoid a spike of cases that subsequently depletes resources, such as
ventilators, N95 masks, extracorporeal membrane oxygenation (ECMO) machines, and hospital beds. The World Health Organization (WHO) has recommended strategic social distancing of the general population and quarantine and isolation of infected persons to slow the spread of the disease.

Limiting provider exposure to patients under investigation (PUI) reduces unnecessary risk of the transmission of disease. Inherently, increasing the number of providers who interact with a COVID-19–infected patient by even one creates a potential exponential increase in the number of exposures. Maintaining traditional clinical involvement in the ED results in medical students becoming that one extra provider.

Data from China show that a large population may asymptotically carry COVID-19, and 86% of COVID-19–diagnosed patients obtained the disease from asymptomatic carriers. Thus, exposed medical students who become asymptomatic carriers could unknowingly aid in spread of the disease to family and friends, thereby worsening the pandemic.

In light of this concern, many EDs enacted policies to prevent students from participating in the care of potential COVID-19 patients, even prior to the AAMC statement. This does not, however, decrease their interaction with other providers in the ED who have been exposed to such patients. Moreover, medical students share workspaces, chairs, and computers with those who are caring for PUI. Thus, restricting care of patients diagnosed with COVID-19 alone would not entirely eliminate contact with fomites on workspaces or with possibly infected staff.

**Student Safety**

Continued medical student exposure also increases the likelihood of medical students becoming symptomatically affected themselves. While older age has been linked to increased likelihood of developing ARDS and death from COVID-19, emerging and evolving data illustrate that young, healthy patients may have a higher risk of severe illness than previously assumed. Data from the Centers for Disease Control and Prevention (CDC), at the time of this writing, show that 38% of the patients hospitalized in the United States are between the ages of 20 and 54 years. Twelve percent of those admitted to intensive care units (ICU) were between the ages of 20 and 44.

Regardless, a lower relative risk does not exclude nor totally protect medical students from such an outcome. Many of the tasks that medical students perform in the ED must be duplicated by a resident physician or an attending, such that we should be mindful of what we ask students compared to what we gain by doing so. In that vein, medical students may be viewed as nonessential providers, which may be regarded as lending flexibility and safety to students while they train.

**Conservation of Limited Resources**

There is a growing conversation about resource conservation, with hospitals reporting limited supply and access to personal protective equipment (PPE) and other vital supplies. In fact, President Trump recently signed an executive order activating the Defense Production Act, which was last enacted during the Cold War Era but could now serve to increase the production of crucial supplies and equipment. Regardless of the success of attempts to “flatten the curve,” the need to maintain supplies over the course of the pandemic will persist. Students utilizing already scarce supplies in the performance of a task that may require duplication by a senior provider may represent a poor allocation of resources.

**Medical Students as a Vulnerable Population Within the Hierarchy of Medicine**

Even in the absence of a pandemic, medical students may lack comfort with voicing or otherwise reporting their comments, questions, and concerns. This may be heightened during a pandemic or other health care crisis, where there may be concern that other priorities far exceed the students’ worries or needs. An inherent power differential exists for medical trainees given the hierarchical nature of academic medicine and the importance of learner assessments for future career options. Students may fear repercussions from those responsible for their clinical experiences and grades when voicing unpopular opinions, which may include a concern for their own safety.

**Loss of Educational Value**

As the number of PUI grows in departments restricting medical students from evaluating PUI, fewer patients remain safe and appropriate for medical students to see. In preparation for residency, the fourth-year curriculum should provide students with opportunities for independent patient care as appropriate. Without patients to care for, a clinical rotation loses its essential educational value.
In such a time of crisis, attendings and senior residents who typically teach students may shift their full focus to managing COVID-19–related issues during shifts. In addition to patient volume and severity of illness, which serve as barriers to education even outside of pandemics, new and unfamiliar protocols may additionally burden clinician-educators. In this scenario, the medical student may not receive adequate attention or teaching even if suitable patients exist for them to see.

**ALTERNATIVES TO THE TRADITIONAL CLINICAL EXPERIENCE**

Undoubtedly, a pandemic brings about unique challenges in providing undergraduate medical education. Instead of choosing between patient and student safety and students’ education, we advocate for a consideration of alternatives to the traditional EM clinical rotation and clerkship. If we consider direct patient care as the criterion standard, how can we modify it to accommodate a pandemic? What possible surrogates can we provide our learners in place of direct patient care? Below, we present a number of creative solutions which delicately balance minimized risk with maximized experience (summarized in Table 1).

**CONCLUSION**

While this current pandemic presents new challenges, it will not be the last crisis faced by our health care system. Failing to consider our medical students’ role now disservices current and future students. Acceptable alternatives to the clinical experience vary by medical school and even by department. Of note, medical schools and students should consider possible ramifications regarding existing power dynamics and differentials in the employment of certain strategies discussed above. These are included to illustrate the full scope of alternatives and are already benefiting several communities during this pandemic. Several additional considerations not explored here exist, including how to navigate residency applications when many students miss rotation experiences due to suspensions and cancellations, how to mitigate the impact of isolation on student mental health, and other items vital to maintaining sound and robust training for our future physicians.

The authors express special thanks and appreciation to Drs. John Burkhardt and Carrie Commissaris; Mr. Austin Cooper; and Drs. Michelle Daniel, Laura Hopkins, Rob Huang, Will Peterson, Rama Salhi, and Ryan Tsuchida.

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To the Editor:

The spread of COVID-19 has had a substantial impact on healthcare systems around the world. Increased pressure has led to doctors being called out of retirement, as well as a call for volunteers in healthcare settings and within the community. Medical education has been transformed within the space of weeks, with clinical placements cancelled and teaching and examinations moved to an online format. This raises important questions as to what the role of medical students should be during this pandemic.

Many students feel a sense of duty and solidarity toward the national health systems, believing that they are failing both the public and themselves by not volunteering to help. On the other hand, with limited PPE, some argue that their potential contributions do not justify the risk of infection. Furthermore, some students currently volunteering do not feel they are sufficiently competent, believing that there is always someone more qualified to complete the task.

For hospitals, students provide welcome relief for staff, helping with non-infectious patients or administrative tasks, enabling health care workers to treat those critically unwell. Students have proven to play substantial roles in previous pandemics such as SARS, potentially making them a desirable addition to the health care team. However, the lack of experience and exposure, particularly with students in preclinical years, may limit their usefulness in clinical setting. They would require additional supervision and could potentially be a source of cross-contamination. Some argue students should be encouraged to assist in their communities instead, particularly for those in preclinical years.

Various opportunities to volunteer have arisen for students, such as Imperial College London’s non-clinical and laboratory schemes. This include helping in primary care with reception tasks and working in laboratories for COVID-19 diagnostic testing. Social media has also been utilized, with Facebook groups linking students with medical staff requiring help, whether it be with shopping or childcare. Some students are also taking up paid National Health Service 111 roles, where they are trained to become licensed call handlers. This involves answering calls from the general public who have health concerns, assessing their symptoms, and organizing any further investigations or treatment. Other students are directly assisting vulnerable members in their communities, for example, collecting prescriptions for those unable to leave their homes.

Is being able to contribute during the crisis more important than potential risks? For many students, yes. However, various other obstacles can prevent students from volunteering, including upcoming online exams that are crucial to course progression. Some may also be challenged financially or live with at-risk family members, creating logistical hurdles such as a lack of alternative accommodation to utilize whilst volunteering.

Medical students have rushed to volunteer in hospitals driven by a feeling of duty. They can play an invaluable role in the fight against COVID-19, and we hope to see greater consideration as to how students’ contributions can be best utilized in this pandemic.

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It has been suggested that “the most dramatic learning can come when it is a peer who is disabled, rather than a patient.” The sentiment of Shakespeare, Iezzoni, and Groce are evident in innovations report by Jauregui and colleagues. In this invited commentary, the authors discuss how the team at The University of Washington moved beyond the legal mandates of the Americans with Disabilities Act (ADA) to capture the spirit of inclusion. We examine the benefits of training doctors and clinical researchers with disabilities and the potential impact on the health care system. We build on the work of Jauregui et al., applying their educational approach to an employment model and demonstrate, through our own case report, how these models can be scaled in clinical practice providing benefit to the medical education pipeline. We conclude with a review of the promising practices and contemplate the promise of “crowdsourcing” shared experiences toward creative approaches to the inclusion of medical students with disabilities.

THE VALUE OF DISABILITY

There is incredible value in the message from Jauregui and colleagues. In sharing their experiences, and the multiple benefits of their model, they encourage a robust conversation about what is possible. Providers and researchers with disabilities remind us not to assume functionality or ability based solely on appearance or stereotype. Through the article by Jauregui et al. and other first-hand accounts there is an increased realization that the inclusion of individuals with disabilities in the biomedical workforce is valuable for health care through several mechanisms including increased empathy, increased rapport with patients, and informed care for individuals with disabilities that result in enhanced responsiveness to clinical recommendations.

One might hypothesize that this is due, in no small part, to their experiences as a patient and a person who experienced the health care system as a consumer and provider of services. This unique lens brings a dual perspective on health care services and gives the provider insight into the barriers to navigating health care as a person with a disability. We know, for example, that many providers are not aware of the ADA, nor their responsibility for providing accessible care. Yet, failure to understand the law is only part of the problem. Legal mandates do not diminish stereotypes, which often fuel the assumptions about people with disabilities that lead to disparate care and health outcomes. Stereotypes about disability often lead to misperceptions about the ability of physicians with disabilities to practice and affect the satisfaction and quality of care received by patients with disabilities. For example, the belief that women with physical disabilities are not sexually active leads to poorer health outcomes through attitudinal and clinical barriers, including lack of preventative services.
THINKING ABOUT DISABILITY DIFFERENTLY

Researchers and clinicians have proposed that the inclusion of physicians with disabilities would activate advanced understanding, increase empathy, reduce stereotypes of people with disabilities, improve communication, and spur technological advances for improved care.\textsuperscript{13,27,33-40} This increased knowledge of disability may be activated through the framework of Contact Theory. Contact Theory suggests that negative attitudes and stigma stem from lack of personal and positive contact between groups.\textsuperscript{40,41} According to Allport,\textsuperscript{40} this interaction must occur in a situation whereby the individuals maintain an equal status relationship, socioeconomic status is equalized, and members of the two groups share common goal and are working together to accomplish the same goal and where the interaction is part of the social norm. Jauregui and colleagues’ approach meets all of the aforementioned criteria.

Given this, increased visibility and direct interactions with people with disabilities in health care as health professionals may significantly reduce negative stereotypes. Interactions between physicians, health care providers, and researchers with disabilities in the health care workforce might correct assumptions about disability that are critical to reducing the health care disparities caused by stigma and stereotype. If this occurs, it could create a positive outcome pathway (see Figure 1).

CREATIVE INCLUSION

Medical education is becoming more inclusive, with schools revisiting their previously restricted views of what it means to be a physician with a disability. This is no doubt sparked, in part, by the increased national and international focus on disability inclusion and the sharing of personal accounts and successes by physicians, trainees, and students with disabilities.\textsuperscript{42-50}

Jauregui and colleagues\textsuperscript{2} demonstrate the relative ease of inclusion when teams work together and are creative in their solutions for removing barriers. In this case, a student with a physical disability was faced with barriers in the environment that impacted his ability to take notes and meet standard clinical requirements. This model leveraged existing students in a creative manner that also provided educational benefits to second-year students. An unintended, but impactful benefit of this model was the opportunity for close interaction with a person with a disability, potentially reducing stereotypes through shared experiences and peer-to-peer and student-to-faculty contact through the pathways mentioned above.

This model reduced the need for a full-time scribe or intermediary, which resulted in significant cost savings. It also fostered a sense of community and connection, which has been shown to reduce burnout.\textsuperscript{51} The model of Jauregui and colleagues, while applied to a specific rotation, holds promise for scalability to an entire clerkship year and residency and into practice. Indeed, our own case report shows how these
models can be scaled in clinical practice providing benefit to the medical education pipeline.

**CASE REPORT OF RESIDENT WITH PHYSICAL DISABILITY**

A gastroenterology fellow sustained a C3–C4 incomplete spinal cord injury. As a wheelchair user with limited hand function, he sought a path to practice in a nonprocedural specialty. With technological advances, such as Picture Archiving and Communications Systems (PACS), diagnostic radiology was increasingly computerized. Provided that one could meet the ACGME core competencies, and pass the licensing examinations, the essential tasks of viewing and reporting imaging examinations was within his ability.

While radiology appeared promising, the doctor would need to complete a new residency in radiology, 4 more years of training, and possibly an additional year of fellowship. The fellow matched into a residency in radiology. The program director worked closely with him to create an environment and structure where the resident could thrive. He was not required to perform procedures, but was expected to know their indications, and contraindications, complications and to describe how to perform them. The program created a strict schedule that allowed the resident to perform necessary self-care. In lieu of weeks of night call (night float), the resident took once weekly call from 5 PM until 10 PM. In this way, he completed approximately the same number of hours as his peers, but in a modified schedule. Finally, the resident was always on call with a second resident in the event that a procedure was required (e.g., ultrasound, place an IV, or perform a fluoroscopic procedure). The resident utilized dictation software to record impressions and was able to review the same number of images as his peers.

**CAUTIONS WHEN CREATING A MODEL FOR INCLUSION**

There are several cautions for creating a model that includes students as scribes and assistants. First, language is a crucial equalizer, and careful attention should be paid to the terms used to describe disability and the position (see Table 1).

It is vital for attendings, preceptors, and others in positions of teaching to model respectful and inclusive behavior and to assume competence. Assuming competence is the idea that medical students are presumed to be competent to learn a skill or to provide basic care for patients. When working with a student with a disability, many faculty presume incompetence and ask or require that the individual with a disability prove their ability in advance of any instruction and in advance of the same expectations of their peer group. Faculty and administrators can model appropriate interactions with students by assuming competence and treating the student in an equivalent manner to his or her peers. Ensuring appropriate accommodations for students is also central to creating a model.

**SCALING THE MODEL OF JAUREGUI AND COLLEAGUES**

Programs may hesitate to attempt new models of inclusion at the undergraduate medical education level believing that the model is not scalable in training or practice. There is a concern that if a student graduates, he or she will face barriers in residency given the new responsibility of patient care and that the model will not be sustainable in those settings. However, the resident from our case study created a model similar to that of Jauregui et al. and is now an associate professor of radiology at an academic health system and co-author of this paper (PP).

Working with volunteer services, the faculty member created a model that addresses his professional needs for assistance in navigating the clinic, while also meeting two growing demands: first, the need for international medical graduates to engage with medicine while they study for boards and apply for residency in the US. Through this program, international
medical graduates benefit from ongoing mentoring, exposure to the U.S. medical system, assistance with the match, and potential letter of recommendation for residency. This position also affords them the opportunity to study for their board examinations, while staying connected to the hospital and medical care, keeping them engaged in the health care system. Second, this program affords an opportunity for up to 10 prehealth students to log hours shadowing for a physician, gaining exposure to radiology, and obtaining letters of recommendation. In addition to scribing, volunteers answer the telephone, help manage meals for the physician, and ensure accessible pathways. The volunteer services office chooses appropriate volunteers, maintains a formal description of the job duties, and handles all of the paperwork and training.

This model serves a need in the community for students and international graduates in the pipeline to health professions school and residency, while simultaneously serving the needs of the physician to navigate his clinical day. Similarly, to the unintended benefits experienced by Jauregui et al., this model provides multiple points of contact with a person with a disability that serve as opportunities to combat stereotype. Importantly, the contact is between the physician with a disability and the students and residents who will enter the health care field and ultimately oversee the care of patients with disabilities. Through the tenets of contact theory and the pathway for positive outcomes (Figure 1), it may be that this early contact with a high-functioning physician with a disability reduces stereotypes and assumptions about the abilities of individuals with disabilities.

CROWDSOURCING CREATIVE INCLUSION

The authors applaud Jauregui and colleagues for their innovation, commitment to supporting the student, and their commitment to sharing this case in the literature. Through this “crowdsourcing” of information (including models for accommodation), we can collectively move toward greater inclusion. The inclusion of students in medical education necessitates not only informed processes and policies, awareness of law, and a desire for diversity but also requires creative thinking and a willingness to do things differently as displayed by Jauregui and colleagues and the University of Washington. When medical educators are committed to inclusion for qualified learner, and their actions match the spirit of the ADA, the solutions are often limitless.

CONCLUSIONS

To achieve greater inclusion of persons with disabilities in medicine, creative approaches to inclusion and accommodations are needed. Jauregui and colleagues have highlighted an innovative approach to accommodations during medical training, which leverages a dynamic model that benefits students and their near peers. Additional innovative and successful examples of disability inclusion in medical settings are needed, as these approaches highlight opportunities for enhanced inclusion and the potential for medicine to shift broader societal paradigms about disability.

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I have always known that I have exceptional residents. I have had the privilege of working with the emergency medicine (EM) residents at Sinai-Grace Hospital in Detroit since 2015, first as their Associate Program Director and now as their Vice Chair of Education. Detroit is a tough city, and of the four academic emergency departments (EDs) in Detroit, of which I have worked at three, Sinai-Grace is arguably the toughest. Underlying general health in the communities surrounding Sinai-Grace is poor, access to primary health care is difficult, violence is high. The average life expectancy in some of the neighborhoods surrounding Sinai-Grace is 16 years less than the state average for Michigan.1 You don’t choose to do a residency at Sinai-Grace if you’re looking for a cakewalk. Our residents knowingly sign up for a difficult residency that will make them exceptional attending physicians.

Of course, the Sinai-Grace residents knew what they were getting into before COVID-19; they could not have known what it would mean to work at Sinai-Grace during the onslaught of COVID-19. Many are aware of the terrible atrocities occurring in New York City as a result of COVID-19, but not everyone is aware of the ravaging effects of COVID-19 in Detroit, particularly at Sinai-Grace. We got the unfortunate attention of the Centers for Disease Control and Prevention because there was a time at which we apparently had one of the highest COVID-19 mortality rates of any hospital in the country.2 Refrigerated trucks to assist our overflowing morgues greeted us as we walked into work each day. Sinai-Grace is a hard place to work on a good day and was often a sad, frustrating, and emotionally exhausting place to work in the past two months.

But this is not a story of the mortality rates of COVID-19 or a discussion of health care disparities. This is a story of perseverance and dedication, told from the perspective of two Sinai-Grace EM resident physicians: one who took it upon himself to create a proning team while rotating in the intensive care unit (ICU) to combat the high mortality rate in our intubated COVID-19 patients and the other who has been risking his life going to work in the ED every day, only to be thanked by having his first attending physician job contract withdrawn two months prior to graduation. The work that everyone is doing is heroic: here are two of their stories.

**DR. JEFFREY MITCHELL, PGY-2**

Most individuals in medicine enter the workforce to help patients. They use their knowledge and skills to treat, and hopefully cure, victims of the illnesses that plague them. During this pandemic, COVID-19 infection greatly stressed our ability to do our job. Patients quickly overloaded the ED, the hallways lined with patients. Oxygen tubing was taped to the floor like snakes winding their way through the jungle of chaos. Multiple intubations occurred every hour. The medical ICU was similarly overwhelmed as intubated COVID-19 patients overflowed from the medical ICU into available surgical ICU rooms and finally the step-down floor.

This continued for weeks, without much improvement in patient outcomes. No matter what treatments were provided, nothing seemed to improve outcomes for the sick, intubated patients. Hydroxychloroquine, antibiotics, steroids: all were initially thought to improve and treat COVID-19, but none improved...
outcomes. Ventilator requirements increased on all patients; vasopressor requirements followed. Each patient slowly slipped into renal failure and required dialysis, but the clot burden from COVID-19 made dialysis access difficult to maintain. As health care workers, we felt helpless, without any definitive treatment for our patients. We watched as their health deteriorated slowly until death.

In a state of disbelief and hopelessness, I searched for answers. Early on, COVID-19 was thought to be similar to acute respiratory distress syndrome (ARDS), which has been shown to improve with proning. Typically, automated beds are used to prone patients at our facility, but due to the sheer number of intubated patients, this was not a viable option. It was at this point that I decided that we needed to assemble a proning team. Although seemingly easy to implement, creating a proning team proved to be more challenging and labor-intensive than what our overwhelmed ICU could handle, so I chose to take this task on myself. I first assembled a team of occupational and physical therapists since bed mobility is part of their everyday work. In turn, they enlisted the help of each patient’s nurse and respiratory therapist to prone the patients. This was an interdisciplinary effort to fight COVID-19. After a month of defeat, my grief was replaced with a glimmer of hope that together, health care workers can overcome the burden of this disease and improve the lives of those affected by it.

**DR. STEVEN SALCIDO, PGY-3**

Prior to coronavirus, residency at Sinai-Grace was grueling, and this only increased with the arrival of COVID-19. Patient volumes initially increased dramatically during the surge, and the virus was taking the lives of many each day. This led to increased physical and emotional exhaustion, which even our attending physicians had never encountered. Even though EM physicians see and experience death daily you can never prepare for the amount of death during a pandemic. For the first time, residents and board-certified EM attendings were at the same educational level with the virus and tackling this virus on as equals. Together, we combed through literature from countries that had experienced COVID-19 before us. A good grasp on managing these patients was far from perfect; however, day by day we made changes to our practice based on what we were learning and experiencing in the hopes of better patient outcomes.

As a resident and medical student I remember being told that I had chosen a noble profession, one in which I would always be needed, and that I would likely never go without a job. Earlier this year, prior to COVID-19, many graduating EM residents spent months trying to find the job of their dreams, including myself; most signed contracts and thought they knew where they would be on July 1, 2020. In the months leading up to COVID-19, many secured housing and spent large amounts of money for licensure and other expenses related to being a new attending physician. Many began planning for a family, and all of us began to prepare for a life that was promised to be secure after residency. Despite all of these assurances, it all suddenly came crashing down after COVID-19 overtook the nation. As hospitals ended elective procedures and stay-at-home orders were put into place, ED and hospital volumes drastically dropped. Unfortunately, some residents with signed contracts for their first attending physician job were told that their contract was being rescinded, as groups were unable to take on any more physicians due to COVID-19. I was one of these residents.

This left me and other residents to begin the job hunt anew, eight weeks prior to graduation. This time, however, was much more difficult. Job markets have been completely demolished and the few available positions are often located in areas far away from where our families are and often with an hourly rate 40% to 50% less than usual. This has left many residents with the uncertainty of being able to make a living or start a life after residency. I feared that a position might not exist this year, leaving me and other residents jobless. If this is the reality, what am I to do?

I shared my situation and experience with other residents who similarly expressed their concerns. Even those with secured positions are concerned that their hours will be cut or they will be asked to take time off without pay. This is a difficult reality given the massive debt many of us hold and the time spent missing our most precious moments during our 20s and 30s to get to this position in our lives. It truly is a major let down. We went into medicine to help people and, given the reality of the situation, some may not even be able to do that. A good thing about EM residents is that given the adversity we experience in the ED every day, we are better able to adapt to changes and difficulties. This darkness that COVID-19 has caused will have a lasting impact and consequences in
medicine. Luckily, pending new licensure and credentialing, I have found a new job in a different state. However, I do fear for those residents that follow me in the coming years. I fear that they will face a more saturated job market with limited possibilities. Generally, in life, when an imbalance occurs, things correct slowly over time. I just hope this return to a new normalcy is equitable for all residents in the future.

CONCLUSION

Everyone in health care and in the world has been affected by COVID-19, in many different ways. I am proud to work alongside the Sinai-Grace EM residents, as I am sure all faculty is honored to have their residents by their side. Residents, trust us, this will all be worth it in the end.

References

What Can a Pandemic Teach Us About Competency-based Medical Education?

Sally A. Santen, MD, PhD1, Michael S. Ryan, MD, MEHP1, and Wendy C. Coates, MD2,3

The COVID-19 pandemic is disrupting educational and clinical environments, and in some regions the workforce may not be adequate to respond to the needs of the community. This, therefore, presents an opportunity for the medical education community to reconsider time-based training and embrace a competency-based progression to accelerate entry into the workforce. This commentary discusses undergraduate and graduate medical education response to workforce pressures of COVID-19. On the one hand, some medical schools are moving toward competency-based (early) graduation from medical school. On the other hand, residency programs have generally held to time-based completion of training. In the context of this clinical and educational disruption, there are two challenges to CBME progression of trainees. The first challenge is whether there is trust in competency-based assessment to permit time-independent progression. The second involves a number of logistic issues to competency-based progression.

COMMENTARY

For over a decade the medical education community has explored competency-based physician training.1 Competency-based medical education (CBME), organized around predefined abilities and outcomes, is intended to improve patient care through ensuring competent performance. CBME gained significant traction in the United States with the launch of the Accreditation Council on Graduate Medical Education (ACGME) Outcome Project in 1998.2 Each specialty has subsequently determined subcompetencies and developmental milestones for their residents. In medical schools there has been similar attention to outcomes-driven models. While the Liaison Committee on Medical Education (LCME) has not mandated specific competencies, the standards require that each school set the outcomes and ensure that every graduate achieves them.3

Typically, both undergraduate and graduate medical education mandate that trainees achieve competencies while adhering to a time-based structure determined by the relevant accreditation organization (LCME or ACGME). For the Doctor of Medicine (MD) degree, the LCME mandates a minimum of 130 weeks and most schools require 4 years of training. For residency the duration of each specialty’s training is determined by the program requirements (ACGME) and the specialty board. For example, the duration of emergency medicine’s (EM) postgraduate training program is set by the American Board of Emergency Medicine (ABEM), requiring 46 weeks per year of training for either 3 or 4 years.

The COVID-19 pandemic has resulted in numerous impacts on health care delivery and medical education training. In a time of greater accountability of the profession, medical educators must ensure that every...
graduate is prepared for practice with the needed knowledge, skills, and attitudes. In this article we argue that the pandemic, and perhaps more importantly, the medical education community’s response to the pandemic, has resulted in an additional unanticipated opportunity for the CBME movement. Namely, the pandemic has pulled back the curtain on our inherent trust and distrust in the CBME construct. We highlight how the CBME model could play to our advantage in responding to educational and workforce concerns during the current pandemic, but how the actions of the medical education community may point toward a lack of confidence in this model.

**THEORY OF CBME**

Training of physicians is a continuum with key transitions from medical school to residency to independent practice. Following the CBME model, these transitions should be based on achievement of competency. However, in 2010, Hodges highlighted that the traditional model of medical education is “a time-based (or ‘tea-steeping’) model, in which the student ‘steeps’ in an educational program for a historically determined fixed time period to become a successful practitioner.” In contrast, the CBME model focuses on the functional capabilities of the trainee at the time of transition (the graduating medical student, resident, or independently practicing physician). While there is some progress toward CBME, mostly through the clearer definitions of what is competent at each level of training and in each specialty, medical education for the most part remains time-based.

**HOW CBME COULD APPLY TO THE COVID-19 PANDEMIC**

It is during times of severe disruption, such as the current COVID-19 pandemic, that there is pressure on the medical education system to create necessary change to address society’s pressing needs. This was the case during previous times of national need, such as World War II and the Vietnam War, when many medical schools shortened their curriculum to 3 years. We are observing a similar situation in the present climate. In some areas, the actual and anticipated needs for patient care have overwhelmed the health care workforce. In response, there is a critical need to surge the workforce. This, therefore, presents an opportunity for the medical education community to reconsider the dogma of time-based training and embrace a true CBME model. If learners are deemed competent for residency training or independent clinical practice, there would be obvious advantages to society if we could allow them to enter the workforce at an earlier time.

**RESPONSE OF THE MEDICAL EDUCATION COMMUNITY**

The COVID-19 pandemic has created an opportunity for medical education leadership to consider the potential for learners at various training stages to make the transition into the next level of training or practice based on their competence. However, the various professional, accrediting, and certifying organizations’ response have been diverse. The responses highlight disparity in how CBME has been implemented, underscoring bureaucratic and logistic issues that prevent a true competency-based model.

**TRANSITION TO RESIDENCY**

Early in the pandemic, the LCME advised that “the medical school should review its educational program objectives (EPOs), the learning objectives of its required courses and clerkships, and required clinical experiences and skills. If students have met these requirements and been assessed on these required learning objectives, they may be eligible for early graduation. The school should confirm the eligibility of each student with its Student Advancement and Promotion Committee.” In other words, if the students met the competencies required by the school for graduation, they could be allowed to graduate even in advance of the traditional 4-year timeline.

In response to the need for health care providers and with endorsement from the LCME, medical schools, especially around New York, announced that they would graduate students early. Schools reviewed their students’ academic performance and offered students the opportunity to graduate early if they were deemed competent. Medical school leaders were confident in their graduates’ readiness for residency. Although the window allowing a compressed timeline for training was brief (only about 2 months), this represented a paradigm shift that allowed senior medical students who met the preexisting competency outcomes to graduate, even though they had not completed the full duration of the curriculum. As a
consequence, medical students have been able to enter the workforce either as interns or “junior physicians” in supervised settings. The outcome of this experiment has yet to be determined.

This approach represented a major step forward for medical schools to shift from time-based to competency-based training. Unfortunately, the ACGME voiced significant concerns including inadequate orientation to residency, limited supervision, binding match commitments, uncertainty if the additional months would count toward the time-based residency duration, and funding. Thus, in some health systems the newly graduated physicians entered the workforce but not as interns in their specific residency program. In other settings, some of them were able to start their specific residency program early.

**TRANSITION TO INDEPENDENT PRACTICE**

The same urgency to increase the workforce to meet the regional health care needs of caring for the surge of patients during this pandemic put pressure on residency programs to graduate trainees early and certify their ability to practice independently. The American Board of Medical Specialties (ABMS), responsible for physician certification, and the ACGME which accredits residency and fellowship training programs, hold a “commitment to the public to ensure that physicians practice medicine safely and efficaciously.” While they acknowledged the programs’ expertise and authority to determine readiness for unsupervised practice they noted that this “authority and judgement are especially important during times of crises when traditional time- and volume-based educational standards may be challenged.” However, in contrast to the LCME, there was no pathway offered for transition from time-dependent to competency-based graduation from residency. Instead, leadership organizations including the ACGME, and in the case of EM, the Residency Review Committee and ABEM did not take steps to permit early completion of residency through competency-based progression. ABEM mandates 46 weeks of training per year and a COVID-related guidance noted that program directors should allow residents to be quarantined for a short period of time without extension of training and allowed for exceptions to the 46 week per year on a case-by-case basis. The focus was on time in training and less so competency-based progression.

The pandemic has severely disrupted training with closed clinical settings, severely decreased patient and surgical volumes. It is possible that some specialties may need to determine different means of determining ready-for-independent practice. For example, if a specialty requires a set number of cases or months in clinic, leadership may need to return to competency or entrustment models for program completion.

**WHAT THESE CHALLENGES SHARE ABOUT OUR TRUST IN CBME**

This disparity in approaches across professional organizations and accrediting and certification bodies is instructive. Medical educators have not fully embraced CBME and they do not trust in trainee progression using a competency-based model. We think that there are several reasons that there was not a widespread movement to transition residents early to independent practice, which point toward two inherent gaps in the CBME model in practice.

The first gap is assessment. The ACGME and ABMS noted in reference to COVID that PDs [program directors] and CCCs [clinical competency committees] have the ability to assess trainee readiness for unsupervised practice in a variety of different ways, including utilization of Milestone data, Entrustable Professional Activities (EPAs), and review of data from a variety of assessment methods (in-training examinations, clinical evaluations, case/procedural logs, multisource feedback, direct observation in real or simulated situations, etc.). While the types of competency assessments may vary across specialty, program, and institution, the ABMS and ACGME do expect programs to use rigorous, valid, and reliable combinations of assessments that are appropriate within each specialty.

Despite the fact that EM residency programs report over 300,000 milestone ratings each year to the ACGME (23 milestones twice per year for each of more than 7,000 residents), it is clear that there is a perceived lack of validity, reliability, or trustworthiness in that process. It is not clear that residency programs, if given the green light, would have had sufficient evidence or feel comfortable to make the high-stakes summative competency decision to allow residents to graduate and enter independent practice.

The second gap is the logistic challenge posed by CBME. Time-dependent progression is practical and
predictable. Program directors know when residents will graduate and they can, for the most part, plan for the ED workforce to care for patients. While there are minor disruptions due to leaves of absence for medical reasons or pregnancy, program directors can depend on a set number of work-months to run the ED. If residency programs utilized competency-based progression, ED staffing challenges would require modification. In particular, it would mean the loss of advanced residents who are relied on for teaching, efficient disposition of patients, and care of the more critically ill patients. Further, the funding for residents is fixed in a time-based model so movement to competency-based progression would require a revision in the current funding model.

WHAT THESE GAPS MEAN FOR THE FUTURE OF CBME

Dr. Whelan of the Association of American Medical Colleges noted that “the COVID-19 pandemic is dominating our educational and clinical environments and is now the biggest disruptor.”17 When given the opportunity and necessity to transition to a CBME model of training to rapidly increase the workforce, for the most part, the medical education collective did not seize the moment. This illustrates a clear challenge to realization of CBME and is a call to action.

While substantial time has been spent investing in competency-based paradigms such as milestones, when given the opportunity during the disruption, the field was not ready to act. Dr. Nasca, from the ACGME, noted that “the concepts of competency-based medical education that have been introduced over the past 7 years position us favorably to deal with individual decisions that program directors will face as we emerge from the first phase of this crisis.”18 So time may come. First and foremost, EM needs to invest time, energy, resources, intellectual capital in designing, testing, and implementing systematic programs of assessment to ensure competent transition to unsupervised practice.19,20 Educators need to trust the programmatic assessment data to be able to measure competency. There are ongoing efforts—the ACGME is revising EM milestones21 and there is a project looking at EM Entrustable Professional Activities.22 These will provide the opportunity to reengage with methods of assessment, building on the lessons learned and the increasing expertise of the educators in EM and beyond. There will need to be careful research to collect validity evidence for instruments used in assessment as well as summative judgments rendered. Importantly, exploring more distant outcomes such as patient outcomes research will be needed. It is only through good assessments that we will achieve the outcome we desire—trustworthy assessments to ensure competency to practice and ensure the safety of patients and society.

The pragmatic barriers are more difficult. They require working with Centers for Medicare & Medicaid Services (for funding), ACGME (for accreditation), and programs to manage the variable transition points. It may be helpful to work within the specialty, but ultimately it will require collaboration across organizations such as the Coalition for Physician Accountability, which is 12 physician organizations with the mission “to advance healthcare and promote professional accountability by improving the quality, efficiency, and continuity of the education, training, and assessment of physicians.”23 By working together, seamless competency-based transitions can be actualized. It will be important to provide a feedback loop, to ensure that the graduates are indeed competent and ready for practice.

In summary, we hope that EM educators take this opportunity to lead the field first in rigorous assessments supported by validity evidence. The next step is to build programs of assessment that lead to trustworthy summative decisions to advance progress of residents in residency and into independent practice. Meanwhile EM and other educational leaders will need to work with organizations such as the ACGME, ABMS, as well as funding sources (Centers for Medicare & Medicaid Services) to address the logistic and funding issues. Through addressing these issues, we can further CBME in to a practical reality.

References


Optimizing Lectures From a Cognitive Load Perspective

Jaime Jordan, MD¹, Jason Wagner, MD², David E. Manthey, MD³, Meg Wolff, MD, MHPE⁴, Sally Santen, MD, PhD⁵, and Stephen J. Cico, MD, MEd⁶

ABSTRACT

Lectures are a common instructional method in medical education. Understanding the cognitive processes and theories involved in learning is essential for lecturers to be effective. Cognitive load theory is one theory that is becoming increasingly recognized in medical education and addresses the appropriate use of one’s working memory. Memory is essential to knowledge acquisition. Two types of memory can be considered, working memory (processing of information) and long-term memory (storage of information). Working memory has a limited capacity. Cognitive load refers to the amount of information processing activity imposed on working memory and can be divided into three domains: intrinsic, extraneous, and germane. By attending to cognitive load, educators can promote learning. This paper highlights various ways of improving cognitive load for learners during lecture-based instruction by minimizing extraneous load, optimizing intrinsic load, and promoting germane load.

Lectures are a common instructional method in medical education. For educators to optimize their lectures and effectively convey information, it is important to understand the cognitive processes and theories involved in learning. One such theory that is becoming increasingly recognized in medical education is cognitive load theory. Cognitive load theory addresses the appropriate use of working memory. Memory is essential to knowledge acquisition. We can consider two types of memory, working memory and long-term memory. Working memory has limits, both in the amount of information and in the duration of time that information can be retained. In contrast, long-term memory has a much larger storage capacity. In an effort to promote learning, educators seek to help students process and package new information in their working memory so that it may be stored and recalled from their long-term memory. Both the number of pieces of information and the complexity of the information being learned or retained can have an effect on the overall retention of information.¹ Cognitive load refers to the amount of information processing activity imposed on working memory.² An example is a case presentation where the students are expected to calculate Sgarbossa’s criteria in a patient with an abnormal ECG while thinking about the medication dosages for the treatment of shock, so it can also be thought of as the effort being used in working memory.³

When presented new material, our minds work to process that information from our working memory into our long-term memory. Three core concepts to understand about working memory are information processing, short-term memory, and limited capacity.⁴ The information processing of new material is handled through visual–spatial and auditory pathways. When those two pathways are at odds with one another, it slows the ability to process new information. Most experts suggest that working memory can only handle seven (plus or minus two) items at any

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one time.\(^5\) Presenting too much information will decrease the amount of information retained given that working memory has a limited capacity and can only handle so much processing at one time before becoming saturated. A representation of the mental architecture of memory and the role of Cognitive Load Theory from Orru and Longo is shown in Figure 1.\(^6\)

Cognitive load can be divided into three domains: extraneous, intrinsic, and germane.\(^4\) Decreasing any one of these domains allows the others more space to function. Extraneous cognitive load refers to the resources devoted to the processing of the information presented. Therefore, this load is artificially introduced by how the educator chooses to deliver the information and the setting in which the learning takes place. As this is the most malleable domain of cognitive load, it is the educator’s responsibility to keep this as low as possible.\(^7\)

Intrinsic cognitive load refers to the resources devoted to understanding a specific topic.\(^8\) Consider electrocardiogram interpretation versus naming the four chambers of the heart. One is intrinsically more difficult to learn. It is easier to simply recall names of anatomy compared to understanding complex processes such as the electrical conduction system of the heart and how abnormalities in processes are depicted in diagnostic testing such as an electrocardiogram. However, this is dependent on the learner’s expertise and experience in the topic area. This point becomes important when introducing new material versus adding to their knowledge base or teaching learners of different levels at any one time.

Germane cognitive load refers to the resources devoted to putting the newly acquired material into the long-term memory. Learning does not occur until the information is stored in long-term memory, so educators must promote giving most of the working memory capacity over to this domain.\(^9\) Educators can also decrease germane load by developing a schema for the new information or intertwining it with already developed schema. A schema is more than a framework or outline; it is the arrangement of an experience into a specific organized manner of perceiving it rationally. For example, a schema for pyloric stenosis could be a 6-week-old male with projectile, nonbilious emesis who is always hungry. This arrangement will also organize how our memory responds to a complex situation or a specific stimuli. The brain often recognizes a simple schema as a single item of the previously mentioned seven-item limit.

Given the volume of information to be learned in medical school and residency, it is important that educators understand the effects of cognitive load and attempt to minimize unnecessary load whenever possible in order to allow maximal learning to occur. The aim of this paper is to discuss various ways to improve cognitive load in lecture based instruction by minimizing extraneous load, optimizing intrinsic load, and promoting germane load. A summary of tips for optimizing lectures from a cognitive load perspective can be found in Table 1.

**MINIMIZE EXTRANEOUS LOAD**

**Environment**
The education space should be optimized to minimize extraneous load. During education sessions (especially large group didactics) educators are constantly vying for audience attention.\(^10\) English speakers talk at a rate of about 125 words per minute, while listeners can
comprehend roughly 400 words per minute. This extra bandwidth can be used by learners to mentally work on more complex topics while listening but is often used to attend to distractions or thoughts other than the lecture. Electronic devices such as laptop computers, tablets, and smart phones are a constant distractor in the modern world. It is the educator’s job to engage the audience without drowning them with information.

In considering the educational space, it is important to minimize potential distractions from the environment: avoid simple disruptions in the clinical environment such as high-traffic areas or spaces that are loud or have frequent overhead paging. In lecture halls, consider banning electronic devices. Audience members may complain that they “need” their devices to take notes or research questions about the content during the lecture, but research shows that analog notes with paper and pen (rather than keyboard typed notes) enhance retention. The theory behind this is that, since it is not possible to write down every word the instructor says, some preprocessing of information is required to put it into shorthand. This preprocessing jump starts the neuronal connections necessary to transfer information from working memory to long-term memory.

An educator must carefully consider his or her instructional plan and his or her learning environment accordingly, taking into account room set-up, lighting, and audiovisual systems. Will it be a large group didactic or small group discussion? Will there be hands-on activities or instructor lead demonstrations? It is important to size up the room and ensure that it set up appropriately whenever possible. For example, chairs set up like a theater are less conducive to small group discussions compared to round tables. If the group is very large and scattered throughout a huge room, it may be difficult for all learners to see an instructor lead demonstration. In this case, having a video camera with zoom capabilities that can be displayed on a large screen may be helpful. With the education style in mind, ensure that there is proper lighting and the audio visual system is operative. For visual screen presentations, lighting in the front of the room should be dark enough for the screen to pop, but bright enough elsewhere to keep the audience alert and allow for note taking. The instructor should be the main attraction, and other distractions should be kept at bay.

### Content

The content should be focused on the learning objectives. Extrinsic material such as jokes, vacation, or family pictures will split audience attention and should be avoided. Attending to the organization of material will prevent learners using valuable cognitive resources trying to recall information that is separated by time, location, or type of source information. Examples of negative strategies would be scrolling between different webpages or delivering instructions on how to perform an examination without the opportunity to practice what they have just been taught.

Another strategy that can be employed to decrease extraneous cognitive load includes using examples that have previously been worked out. Reducing the need to figure out steps can increase the ability of learners to focus on the content rather than the process. For example, if your goal is for learners to understand ventilator management, you could provide examples of various conditions, identify the underlying abnormal pathophysiology, and the appropriate ventilator settings, rather than asking your learner to identify correct ventilator settings for a set of diagnoses. However, there are times when the process is important, such as in teaching procedures or how to diagnose specific conditions, so that should be taken into account. Another option is using a partially completed task as the starting point, so the focus of the learning experience is on the most relevant portion of the assignment. Using the example above of ventilator

### Table 1

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<th>Domain</th>
<th>Tips</th>
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| Extraneous load | 1. Minimize environmental distractions.  
2. Ensure optimal room set-up and audio visual support.  
3. Focus content only on the learning objectives, taking into account learner knowledge and prior experience.  
4. Utilize visual aids that emphasize imagery rather than text.  
5. Rehearse the session in advance. |
| Intrinsic load | 1. Activate prior learner knowledge.  
2. Limit the amount of material to be covered.  
3. Align content with learner level and experience.  
4. Tailor content to flow from simple to complex. |
| Germane load  | 1. Utilize schema to present information.  
2. Chunk information in meaningful ways.  
3. Incorporate concept mapping  
4. Decrease the level of support as learners advance. |
management, you could again provide examples of various conditions and identify the underlying abnormal pathophysiology but ask your learners to identify the appropriate ventilator settings.

**Delivery**

Delivery can also influence extraneous load. Lectures should tell stories that enhance retention through imagery, oration, and audience engagement. Beginning the lecture with a “hook” that emphasizes the relevance and importance of the subject, such as a clinical case, can help capture the audience's interest. It is important to present information in the format best suited for delivery of the information and to avoid redundancy. Slides serve as a visual guide through the presentation and including variety in slide design with regards to color, movement, and frequency may further enhance the value of this learning tool by helping to maintain audience interest. Aligning verbal and visual content and utilizing pictures and images rather than text can also decrease extraneous load. As previously stated, humans can read and comprehend words much faster than they can speak, so the audience will nearly always preferentially read rather than listen when presented with both options. Additionally, both reading and listening use the same brain regions to make sense of the sensory information received thus the learner cannot process both messages simultaneously. Learners can, however, process visual imagery and words simultaneously, further supporting the use of pictures or images rather than text on lecture slides. Finally, note that the brain processes sentences by breaking them all the way down into individual shapes that make up letters. While this is done subconsciously it is not effortless so reducing written words will also decrease extraneous load. When a learner is trying to recall the content later, instead of trying to put back together all of the disparate words in the talk, they can recall the image, which will assist them in extracting the “chunk” of information.

There are some common pitfalls in multimedia design that can increase extrinsic load. Transitions can be fun and entertaining, but they are distracting. Before including any animation, consider its purpose in enhancing the lecture. Graphic interchange format (GIF) files can reengage your audience, but it will be difficult for the audience to listen attentively while a GIF is playing in the background. If GIFs are used, capture a screen shot of a still and paste it into a duplicate of that slide. This allows the GIF to be played a few times and then the next slide to advance, effectively pausing the GIF and ending the distraction. If video is utilized, embed it into the lecture as part of the slide to avoid failure of internet streaming or the distraction of exiting the slides to play off the Internet. Having high-resolution images and ensuring the reproducibility of colors and backgrounds can ease eye strain and unnecessary concentration thereby decreasing extraneous load. In summary, ensure that the multimedia used is high quality and aligned with the educational content, prioritize images over text, and keep transitions simple.

Apart from visual aids, lecturer performance can also impact extraneous load. The presentation should be well rehearsed to avoid distracting long pauses and oratory fumbles. Confidence and stage presence are extremely important in maintaining audience attention. One way to connect with the entire audience is to make eye contact and slowly move around the room. Speech needs to be clear and at the appropriate volume, cadence and tempo. The lecturer must be aware of nonverbal distractions such overly zealous hand gestures and minimize these. A lecturer who minimizes distractions, matches his or her content to the learning objectives, is well prepared, speaks clearly and loud enough for all learners to hear, and makes eye contact around the room will be best able to convey their message by decreasing the extraneous load of their learners.

**OPTIMIZE INTRINSIC LOAD**

The next important step for educators to consider is how to optimize intrinsic cognitive load for the learners, so that it is not too great nor too small. One way to decrease the intrinsic cognitive load is to activate prior knowledge. Educators can specifically call out information that was previously learned or instruct learners to review important concepts prior to the education session. If an educator is presenting a series of lectures, they can pull previous information forward as a refresher. Spaced intermittent repetition (intermittently returning to material previously presented after a period of time) is a well proven method of improving recall and retention.

Educators must consider the amount of material to be covered. As previously stated, working memory is limited. Miller wrote that the “magical number” for working memory was seven items, plus or minus two. This number does vary between individuals and
changes with age, but the general concept remains the same.\textsuperscript{22} An educator would do well to select a few key concepts they want their audience to walk away with after the time allotted. If one tries to cover too much, the learners will be overwhelmed and retain nothing from the talk or they will retain a couple of items at the expense of everything else.

It is also important to consider the interactions between a learner’s level of domain competence and the required intrinsic load of a given task for that learner and ensure that these are aligned.\textsuperscript{23} Discordant content and learner level can increase intrinsic load. If the material presented is too advanced, learners will use all their resources to understand the information and will not have any left to process it and store it in long-term memory. If the material presented is too basic, learners will become distracted by other things. As previously mentioned, matching content to learner level may be difficult in a large lecture hall filled with learners spanning from early medical students to seasoned faculty. While it may not be possible to satisfy the needs of all learners, there are still methods that can be employed to improve their experience. One option is to split up the audience into learner levels. This seems logical, but requires multiple educators (one for each group rather than a single person for the whole) along with unique content for each group. Another option is to create separate content in the lecture for multiple learner levels. The key here is to indicate what content is aimed at what level. This can be done through symbolism or color coding. For example, interns are yellow, PGY-2s and PGY-3s are green, and PGY-4s and up are red. The color or symbol can be placed in front of points (or on slides) aimed at the appropriate audience. Matching content to learner level is yet another way educators can optimize intrinsic load.

Finally, educators must keep in mind that the less background knowledge a learner has in a given area, the more complex new learning is going to be. Intrinsic load of a complex topic can be eased by breaking it into smaller manageable pieces.\textsuperscript{24,25} Content should flow from simple to complex, starting with something basic and building. As learners progress from less complex to more complex information or tasks, the overall sense of complexity is perceived as lower.\textsuperscript{3,12,17,20} By activating prior knowledge, being realistic about the amount of material covered, matching content difficulty to learner level, and breaking down complex concepts into smaller pieces presented in an organized fashion, lecturers will be able to optimize the intrinsic load for their learners.

**PROMOTE GERMANE LOAD**

Specific attention must be paid to enhancing germane load as this relates to how information becomes stored in long-term memory and thus how learning occurs. Educators can promote germane cognitive load by presenting information in a developed schema from which to work or “chunking” information in meaningful ways. When one memorizes parts of the body, typically these parts are memorized as parts of an organ system. These systems have meaning, with all parts in that system contributing to a certain overall function. In this way, rather than learning all the parts of the body separately, one learns “chunks” of information, thus decreasing intrinsic load and promoting germane load.\textsuperscript{17,26} Different information can be organized or “chunked” in a variety of ways. For example, to memorize a list of items, one can repeat the list in one’s mind over and over. Imagery can be used to create a picture or schema of items (a thin frail elderly patient with pursed lips sitting in the tripod position attached to their home oxygen tank). Another way to “chunk” information would be to describe connections between items. For example in identifying the major components of the circulatory system, an instructor could draw the route of blood flow from the heart to the aorta to the arteries and arterioles to the capillaries to the venules and veins, to the inferior vena cava and back to the heart. Each of these examples of “chunking” can augment germane load.

Educators can also encourage learners to develop how to utilize the new information (concept mapping).\textsuperscript{27} Graphical or pictorial representations that organize and represent new knowledge and connect it back to prior knowledge can be useful in helping learners create and build schema.\textsuperscript{28} Evoking emotional responses through shared experiences or relatable stories can also assist learners in recalling prior knowledge and schema from which to build on. This will also promote learner engagement which is important as learners must still choose to deliberately engage with the material and develop new schemata.

Educators must also keep in mind that novices and experts learn differently. With age, germane load decreases since individuals have more prior elements that can be activated simultaneously. People also become more efficient at dampening or suppressing extraneous information.\textsuperscript{17} Learning chunks of
information comes at a lower cognitive cost than learning the pieces of information individually. When a novice learner is presented with new material, the intrinsic load of the task may exceed a learner’s working memory thereby leaving no mental effort to develop schema. As a result, the learner will not be able to process and commit all of the material to long-term memory. Conversely, when experts are presented with the same material, they are able to retrieve previously developed schema from their long-term memory thus decreasing the intrinsic load and augmenting germane load. With less of their working memory devoted to the intrinsic load of a task, they have more working memory available for germane cognitive load. The more knowledge learners acquire, the more extensive their schemata become and the more likely it is that new material will relate to a previous schemata. By fostering the development of schemata, educators will promote germane load, which has the greatest impact on learning.

**SUMMARY**

In summary, working memory is limited. Educators must be aware of the cognitive load experienced by learners and work to optimize this in their lectures. By minimizing distractions, tailoring content to learner level, organizing information from simple to complex, and assisting in the formation of schema, educators can minimize extraneous load, optimize intrinsic load, and promote germane load. Educators can help increase the amount of information that is committed to long-term memory by allowing learners to devote most of their working memory resources to germane load, thus promoting learning.

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Rethinking Residency Conferences in the Era of COVID-19

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ABSTRACT
The COVID-19 pandemic requires a substantial change to the traditional approach to conference didactics. Switching to a virtual medium for conference sessions presents several challenges, particularly with regard to aspects that rely heavily on in-person components (e.g., simulation, ultrasound). This paper will discuss the challenges and strategies to address them for conference planning in the era of COVID-19.

BACKGROUND
Conference attendance is an essential component of residency training and a requirement from the Accreditation Council for Graduate Medical Education (ACGME).1 The ACGME specifically requires programs to hold 5 hours of planned conference each week, of which residents must attend greater than 70%.1 In December 2019, a novel coronavirus (COVID-19) was first identified in Wuhan, China.2 By March 2020, there were over 100,000 cases worldwide.3 It has been recommended to reduce exposure by avoiding large gatherings, particularly as people who are asymptomatic or presymptomatic may expose other people to COVID-19.2,3 This has led to the cancellation of numerous national health care conferences4 as well as institutional changes for medical school and residency programs with a focus on limiting exposure, including those at traditional didactic conferences. Similar recommendations have been made for prior outbreaks (e.g., H1N1 influenza, 2004 severe acute respiratory syndrome–coronavirus) and may be necessary for future pandemics as well.5 Therefore, it is important to identify strategies to reduce exposure while maintaining high-quality resident education during pandemics such as COVID-19. This paper will summarize these components using emergency medicine as an example. However, these strategies are relevant to other specialties, as well, and all program directors should consider similar applications for their specialties.

DIDACTIC PLANNING
Residency conference planning requires robust time and personnel to deliver quality content that covers the core curriculum of emergency medicine.6 The unexpected and sudden need for reformatting and
potential rewriting of curricula due to COVID-19 has understandably added pressure and challenges to conference organizers. Therefore, it is important to consider their available capacity when constructing a modified educational conference.

Strategic recruitment of personnel is important to temporize the increased workload. Recruitment should include both local and external faculty. Wide recruitment can generate deep reinforcements for your education team and help create connections across communities and institutions. To aid with recruitment, use social media applications (e.g., Twitter) and listservs to recruit guest lecturers, facilitators, and panelists. Consider reaching out to speakers who either recently delivered lectures at national meetings or had sessions prepared for cancelled meetings. The shift to a virtual conference will break prior geographic restrictions and allow shared content to be used for multiple programs at a time, thereby easing the planning burden on any individual conference organizer. Organizers should also search for existing online educational resources (e.g., asynchronous modules, cases, board-review questions) to help offload planning time and avoid re-creation of existing content. There is also an abundance of online resources available. Faculty should leverage these resources to avoid duplicating lectures already available.

To maximize engagement, live and prerecorded lectures should include real-time facilitation through either video or written discussion forums. To maintain engagement of trainees during distance learning, consider incorporating various modalities for content delivery such as virtual chat rooms for small-group case discussions, question-and-answer platforms for assessments and feedback, and virtual classroom software for larger didactics. Limit the number of large-group didactics and focus on more active learning techniques, such as visual diagnosis sessions, expert panel discussions, imaging and ECG review, faculty or consultant interviews, and oral boards.

Some faculty or residents may not be as familiar with virtual conferencing technology, so planners should provide

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**Table 1**

<table>
<thead>
<tr>
<th>Component</th>
<th>Challenges</th>
<th>Proposed Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizers</td>
<td>Current faculty may not have sufficient time to redesign conference each week (particularly if there are staffing shortages)</td>
<td>Consider small offers of gratitude for individuals who contribute</td>
</tr>
<tr>
<td></td>
<td>It can be difficult to get consistent unpaid assistance</td>
<td>Invite others to help (e.g., alumni, other faculty, residents, medical students, residency and clerkship coordinators)</td>
</tr>
<tr>
<td>Speakers</td>
<td>Local speakers may not have sufficient time to create new lectures</td>
<td>Use social networks and established directories (e.g., Twitter, Facebook, FemInEM)</td>
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<tr>
<td></td>
<td>Conference planners may not have an existing speaker list beyond the institution</td>
<td>Engage alumni networks</td>
</tr>
<tr>
<td></td>
<td>There may be insufficient local resources or asynchronous learning materials</td>
<td>Explore national, regional, or local meeting agendas (planned or recently cancelled) and ask speakers to give an already prepared lecture or let them select their area of interest</td>
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<tr>
<td></td>
<td>When relying on an unknown educational resource, the quality can be variable</td>
<td>Consider sharing grand rounds or other sessions between institutions</td>
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<tr>
<td></td>
<td>Faculty need to ensure easy access and sufficient bandwidth for users</td>
<td>Ask local or distant experts on the issue at hand (e.g., medical director for updates in times of COVID-19)</td>
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<tr>
<td></td>
<td>Users may be unfamiliar with the software</td>
<td>Reach out to faculty who are currently on quarantine</td>
</tr>
<tr>
<td></td>
<td>Ensuring active learning can be more challenging</td>
<td>Consider incorporating various modalities for content delivery such as virtual chat rooms for small-group case discussions, question-and-answer platforms for assessments and feedback, and virtual classroom software for larger didactics. Limit the number of large-group didactics and focus on more active learning techniques, such as visual diagnosis sessions, expert panel discussions, imaging and ECG review, faculty or consultant interviews, and oral boards. Some faculty or residents may not be as familiar with virtual conferencing technology, so planners should provide</td>
</tr>
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</table>

FOAM = free open-access medical education; IT = information technology
resources and training options for the platform used in advance of the session. Most platforms will include tutorials and a training guide for new users, as well as a help menu for specific questions. Planners may also consider asking residency or medical school faculty who are familiar with the technology to teach them how to use it and train future users. It is also important to plan ahead to ensure that you will continue to meet requirements of the ACGME, including attendance tracking. One group has described using Google Forms to track resident conference attendance.12

Educators should consider regular incorporation of asynchronous learning (i.e., individualized interactive instruction) to the maximum 20% time allotment defined by ACGME.13 Studies have found that residents enjoy these tools and they can be easily utilized as part of a virtual learning program.14–16 However, programs need to be conscious to avoid exceeding the current ACGME asynchronous learning threshold.1 A summary of strategies for a new conference paradigm is included in the Table 1.

JOURNAL CLUB

Journal club is an important aspect of residency education that traditionally occurs in a social setting (e.g., faculty member’s home) with residents and faculty discussing articles.17 However, to reduce the spread of infection, these large, in-person gatherings are discouraged. To address this, faculty should consider running the journal club sessions remotely via an online platform. There are many resources available to help guide educators with creating an online journal club.17–22 Similar to conference didactics, there should be a mechanism for engaging in real-time discussion and the opportunity to ask questions of the journal club leaders. This can include using synchronous media (e.g., Slack, WhatsApp, chat functions of video software) or group polling (e.g., Poll Everywhere, Kahoot). One potential advantage of virtual journal clubs is that by removing the geographic limitations, residency programs may be able to recruit the original study authors to join the session and add unique insights into the analysis.

SIMULATION

Simulation is a key component of emergency medicine resident education and is included in the ACGME program requirements.1 Traditionally, simulation is performed in a group setting in a simulation laboratory or in situ. However, this can be restricted during situations such as the COVID-19 outbreak. Telesimulation has been increasingly utilized as an approach to provide education, training, or assessment of learners when they are at an off-site location.23–26 This can be run using standardized patients or faculty facilitators over an online platform. Simulated experiences can range from breaking bad news to leading a resuscitation, and some online platforms even allow virtual breakout sessions for debrief.

Low-fidelity cases are available through multiple resources (e.g., MedEdPORTAL, JETem, Foundations of Emergency Medicine). Facilitators can also utilize simulation applications to enhance the real-time experience (https://full-code.com/) or practice asynchronously and debrief as a group afterward (http://emgladiators.com/resus/). Procedures can even be practiced remotely using low cost models from household products.27–29

ULTRASOUND

Point-of-care ultrasound (POCUS) training requires knowledge of the indications, skills for image acquisition and interpretation, and the ability to incorporate findings into medical decision making.30 Traditionally, this has been accomplished with a combination of in-person didactics, hands-on workshops, scanning patients in the emergency department, and image review quality assurance sessions.31 In light of the need for social distancing, each of these educational methods needs to be reconsidered.

Fortunately, there is a wide array of free open-access medical education resources on POCUS already available to reduce the didactic needs, including prerecorded online video lectures (e.g., the SAEM AEUS series), podcasts (e.g., The Ultrasound Podcast), blogs (e.g., 5-Minute Sono), and image banks (e.g., The POCUS Atlas). Similar to the didactic sessions, POCUS faculty should utilize these resources to avoid replicating content that is already freely available. Facilitators can supplement this with live streaming of case-based presentations and image review sessions with synchronous chat discussions for questions and online audience response applications to increase learner engagement.

The opportunities to learn the skills of image acquisition are also more finite due to limitations with group scanning and access to cart-based POCUS
machines. If possible, programs could provide learners with handheld POCUS machines to practice on themselves or family members at home. Faculty could review their hand positioning and images using an online virtual platform (e.g., FaceTime, Zoom). Software-based guidance instruction can assist POCUS users in obtaining and optimizing sonographic views (e.g., Caption Health) and can even perform auto-interpretation of images (e.g., Butterfly IQ, GE Healthcare, Phillips). Some handheld POCUS machines even have built-in feedback options. Faculty could also utilize simulation-based platforms (e.g., SonoSim), wherein residents can practice with normal and abnormal pathology. These platforms can be used for individual learning or in a virtual group environment.

**SUMMARY**

The COVID-19 pandemic requires a dramatic shift in the delivery of traditional residency education including conferences, simulation, and ultrasound education. Given the rise of affordable video conferencing and high-quality educational online resources over the past decade, residency training programs are poised to meet this challenge. Likewise, online communication and social media have created rich collaborative networks of educators within and across countries. Grand rounds speakers may now “virtually travel” to not just one but numerous institutions simultaneously to provide engaging educational sessions. These factors are favorable, but the load of completely redesigning residency conferences remains heavy. Given the unprecedented demands of the COVID-19 pandemic, the ACGME may need to reconsider the percentage of conferences that may be delivered asynchronously. COVID-19 will undoubtedly drive innovation within residency education as we continue our efforts to train the next generation of emergency physicians. Further research will need to be completed to gauge the effect of new delivery models on resident engagement and learning.

**References**

The COVID-19 pandemic has disrupted the usual approach to exploring and applying into emergency medicine (EM) for medical students. On March 17, 2020, the American Association of Medical Colleges issued guidance strongly suggesting that medical students be removed from direct patient care. Many medical schools removed medical students from clerkships and postponed hosting visiting medical students indefinitely. An informal query of EM clerkship directors on the Clerkship Directors in Emergency Medicine listserv confirmed this trend in EM, with a clear majority of respondents pulling their students from clinical rotations and halting visiting student rotations.

For many EM-bound medical students, the crucial spring time period to explore and focus in EM became a vacuum and the standard advice for how to successfully apply in EM was insufficient. With no change in the Electronic Residency Application Service (ERAS) timeline at this moment, the timeline compressed for students to prepare for their application. This disruption forced many educators to reexamine their advising paradigm for medical students applying into EM.

PRE–COVID-19 STANDARDS

Program director surveys routinely demonstrate that evaluations from EM rotations, specifically group standardized letters of evaluation (SLOEs) from home and away rotations, are the highest weighted factors in consideration of an EM residency application. Because of this, expectations have evolved such that EM residency applicants are commonly advised and expected to complete two EM rotations to be competitive. This typically means completing one rotation at their home institution and one away rotation. A positive evaluation on an away rotation offers supporting evidence of translatable skills and can be seen as providing a less biased assessment of a student’s potential to be a successful EM resident than a SLOE from a home rotation. However, the process of applying for and completing an away rotation can be competitive, expensive, and unpredictable for students.

RATIONALE FOR A SINGLE ROTATION

Given the increasingly competitive nature of obtaining away rotations, finding two EM rotations for all interested EM candidates had already become challenging. COVID-19 amplified this challenge. Our EM student programs team supports the Council of Emergency Medicine Residency Directors Advising Students Committee in EM consensus statement that programs should be understanding about a single EM rotation and SLOE in this unprecedented year. We strongly advocate for our national EM community to go one step beyond this statement and to align in a unified
equitable recommendation for a single EM rotation for all EM-bound students.

We recommend a single EM rotation for all applicants for the following reasons:

1. **Equity.** Away rotations in EM are a limited resource, and combined with travel restrictions there is significant potential inequity among students as they seek rotation experiences in a compressed time frame. We believe that students from “orphan” programs with no home EM residency program deserve first access to an away rotation, giving them the opportunity to obtain the critical single SLOE for their application. By focusing home students on rotating at their home program, this can open the door for students who need an away rotation the most.

2. **Wellness.** The significant emotional and financial stress of applying for away rotations that is typical of previous years is exponentially compounded this year. We anticipate that it will be exceptionally difficult this year for students to obtain away rotations. We also recognize that students applying for away rotations may go through the entire process only to have their away rotation canceled. A no-away-rotation policy with a written explanation in SLOEs may mitigate this stress.

3. **Need for flexibility.** There is still uncertainty at many institutions about when direct patient care experiences for medical students will resume. We must ensure that all medical students interested in EM secure one spot to rotate this summer in time for clerkship teams to draft SLOEs prior to ERAS opening. For this to happen, complete schedule flexibility of EM-bound students is of paramount importance.

4. **Safety.** We do not anticipate the risks of COVID-19 to disappear entirely this summer. We acknowledge the personal protective equipment (PPE) limitations that many institutions are facing right now, and we know that supply of and policies around PPE vary from institution to institution. While we expect any institution accepting away rotators to make efforts to ensure student safety, we recognize that it is difficult to ensure a consistent standard of PPE protection across all institutions.

**IMPLEMENTATION**

For those institutions with a home EM program, enacting a single rotation policy means canceling away rotations for your own students. We offer our experience as an example in guiding this process. Working together with the medical school dean’s office, we canceled all EM away rotations for our students for the rest of the calendar year.

To implement this time-sensitive decision, EM student programs teams must coordinate closely with the dean’s office. At our institution, we had multiple meetings outlining the considerations above and coming to consensus on the best plan for our students and educational community. We provided registration with a list of our EM-interested students who were then given priority for summer clerkship spots in our required EM rotation. All students applying in other disciplines were moved from summer spots to rotation dates later in the year. Even with these schedule adjustments, we additionally had to overload our clerkship by two or three students per month and fine-tune the schedule and curriculum to be able to fit our EM-interested students into this compressed time frame and ensure adequate clinical exposure for their rotation experience.

This process requires enhanced communication with EM-interested medical students. It is critical to prioritize clear, consistent communication to students from EM student programs and the dean’s office. Here we held several online group advising sessions. Students had many insightful questions about the no-away rotation policy, and we had open discussions about the rationale for the policy and the ways in which we can provide additional support for them during this application cycle. We recognized specific challenges that this policy posed, including the distress of students who had to cancel or decline away rotation offers at programs they are particularly interested in exploring. We emphasize the uniqueness of this year and its impact on everyone and also reiterated the importance of consistency and equity in our approach.

We also assured students that we will provide a very clear explanation of this policy on their SLOE. Additionally, given that students were not currently on clinical rotations, we offered an online personal statement workshop and ideas on how to start preparing their application materials now so that they can focus on clinical work when they return to clinical rotations this summer.

**DISCUSSION**

There are many compelling reasons for the EM educational community as a whole to adopt a single rotation
policy this year. Advisors and programs have a collective responsibility to our EM educational community. What we do affects others. If we are not able to host visiting students, there are fewer spots for all students. If we send our students out to do visiting rotations, they contribute to the consumption of the scarce resource of away rotations. With a single EM rotation policy, we all can focus on making sure each EM-aspiring student obtains a quality EM rotation experience, scheduling home students on a home rotation and prioritizing any visiting rotation opportunities for students without a home EM residency program. In this reexamined advising paradigm we focus on factors we can control to equitably support students and our community.

There are potential downsides to a single EM rotation policy. Programs and students alike will not have as many opportunities to get to know each other without away rotations. Students with less competitive applications who can improve their chances in the Match by performing well on a second rotation will not have that opportunity. Prioritizing all summer spots for EM-bound students means we may miss those students who “discover” EM later as their desired specialty when they rotate through early in their fourth year. However, we feel that the benefits outlined above strongly outweigh these downsides.

The rationale for a single EM rotation policy extends beyond the time of COVID-19. The very real issues of equity are not unique to this time, but this time prompts us to reflect on what we can do as an educational community to mitigate these issues. We recognize that advocating for a single EM rotation is but one step in the important work of increasing equity in our approach to preparing and evaluating EM-bound students. We look forward to seeing positive changes come out of this challenge. We predict that we may find a single institution’s EM evaluation adequate for programs to make informed assessments. There are additional factors pushing programs to look for ways to evaluate candidates more holistically, including the upcoming pass/fail grading scheme for the USMLE Step 1 examination, and so the time is ripe for revisiting our applicant evaluation paradigm.

We recognize that advisors and students from all institutions are facing similar challenges and hope that this discussion may be informative as each institution considers their best approach. We truly believe that programs, advisors, and students in EM will work creatively to overcome the challenges of this time to strive toward a successful, equitable match year for all stakeholders.

References

Remodeling Point-of-care Ultrasound Education in the Era of COVID-19

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The novel COVID-19 pandemic will alter the educational experience for medical students, residents, and fellows worldwide. It has already led to significant changes within most hospitals, including the cancellation of elective procedures, clinical rotations, lectures, and educational conferences. This is no different in emergency medicine (EM) residencies and fellowships. As the demand for hospital resources has increased, residents and fellows have had to surrender educational activities and conferences to prioritize clinical duties prompting creative solutions within residencies.1

Since 2012, the Accreditation Council for Graduate Medical Education (ACGME) has designated the use of point-of-care ultrasound (POCUS) as one of 23 milestone competencies for EM residents.2 The 2016 American College of Emergency Physicians (ACEP) policy statement on emergency ultrasound advises that a trainee should perform a total of 150 to 300 scans as part of POCUS training.3 Furthermore, the 2011 ACEP Emergency Ultrasound Fellowship Guidelines state that fellows should acquire a minimum of 1,000 ultrasound examinations.4 Although POCUS can significantly enhance clinical decisions, hands-on ultrasound scanning and teaching has significantly decreased in the emergency department (ED).

Historically, POCUS education has consisted of understanding the indications for imaging, learning skills for image acquisition, interpreting ultrasound images, and learning how to integrate findings into medical decision making. Fellowship training also includes research, preparing and delivering educational lectures, quality assurance (QA), and attendance at national conferences. While the Society of Clinical Ultrasound Fellowship (SCUF) has issued guidance on graduation requirements,5 further education guidelines and suggestions are needed. Herein, we describe several practical strategies for both resident and fellow POCUS education (Table 1).

**IMAGE ACQUISITION**

COVID-19 has put a strain on clinical ultrasound educational scanning within the ED for many reasons. First, POCUS is no longer risk-free. Recent evidence suggests that viruses like COVID-19 can survive on surfaces up to 72 hours.6 Ultrasound machines, like other surfaces, can act as a fomite, putting both health care workers and non–COVID-19 patients at risk. Second, PPE is currently scarce, and conservation of masks, gowns, gloves, and face shields for clinical use needs to be considered. ACEP7 and the World Interactive Network Focused on Critical Ultrasound8 have published guidelines on the safe use of ultrasound in the setting of COVID-19. Distancing measures have circumvented traditional fellow–faculty bedside-supervised scanning and teaching, which is especially disadvantageous for current and incoming fellows. The risks of exposing...
residents and fellows to a dangerous and contagious disease for educational reasons must be heavily considered. As a result, many emergency ultrasound programs across the country have stopped educational scanning in their EDs.

Given the length of this pandemic and possible future global emergencies, unique solutions are sought to continue POCUS education. Tele-ultrasound with screen sharing could help mitigate the loss of these bedside scanning sessions. Through tele-ultrasound, an educator can be in a separate geographic location while providing instruction to the scanner. Recent evidence has demonstrated the utility of tele-ultrasound through FaceTime (Apple Inc.) in allowing an expert POCUS examiner to remotely guide a novice scanner.9 Other technological solutions also include portable ultrasound devices such as the Phillips Lumify (Philips Healthcare CX50 CompactXtreme), which can connect through IIT’s Reacts platform (Innovative Imaging Technologies), can link ultrasound educators to the bedside thereby reducing risk to the educators while still providing instruction.

Tele-ultrasound has been shown to be effective with novice learners even after only a brief training period in different parts of the world.10 Instruction can be provided synchronously or asynchronously. Tele-ultrasound already thrives in EM training programs in Uganda and Rwanda, where faculty in the United States review images and provide feedback to residents.11 It also provides an opportunity to collaborate with international partners and augment the education of trainees who can learn from their peers across the globe. Tele-ultrasound is a unique solution at a time when less is more.

Ultrasound simulation devices can also be used to augment image acquisition skills. SonoSim (SonoSim Inc.) is one such product. Trainees manipulate a
probe on a simulated patient and see the effects of their hand movement on acquisition of images and, as such, learn to scan. Other ultrasound simulators can be used for such learning include Vimedix (CAE Healthcare), Blue Phantom (CAE Healthcare), and Kyoto Kagaku (Kyoto Kagaku Co.). Ultrasound guidance for procedural techniques can also be learned through simulation, as phantom models exist to simulate central/peripheral vascular access, nerve blocks, lumbar puncture, thoracentesis, and other invasive procedures.

Finally, as ultrasound machines become less expensive and more portable, they become more accessible. With a personal ultrasound device, residents and fellows could practice on themselves or family members. This may not be an effective means of identifying pathology but could be useful in learning anatomic relationships, sonographic landmarks, and variations in technique.

**IMAGE INTERPRETATION**

Learning how to interpret images is a critical component of ultrasound education. Image review for QA purposes can serve as a platform for much of this education. In fact, QA programs are an integral part of successful POCUS divisions. Images are usually secured on a middleware software that can be accessed remotely. Using online conferencing software, image review can be done virtually through screen sharing. This format allows educators and participants to simultaneously view images and participate in the learning process together. Ensuring feedback to ED staff on the quality of their scans can be continued for both education and reimbursement compliance.

To streamline such efforts, divisions may benefit from discussions with information technology (IT) departments to upgrade remote access to POCUS images and electronic medical records. Informational security should be a priority to ensure protecting personal data by using virtual private networks (VPNs).

Image review can also be accomplished outside of QA. Most mature POCUS programs have databases of teaching images replete with classic and atypical examples of pathology which could be reviewed together with faculty. Trainees review images and video clips of anatomy and pathology and artifacts and learn various scanning techniques and pitfalls of scanning. Like for QA, remote videoconferencing software can facilitate such sessions.

**DIDACTIC EDUCATION**

**Lectures**

Amidst the uncertainty of a pandemic, some programs may prefer to maintain a traditional didactic structure. However, the desire to cultivate camaraderie and connection during the changing clinical atmosphere may lead programs to prefer online video conferencing. Utilizing a video-based conferencing platform, such as Zoom (Zoom Video Communications, Inc.) or WebEx (Cisco WebEx), trainees can continue to meet regularly and learn. Video-based conferencing platforms offer the ability to screen share slides in real time as well as a record didactics for future viewing. Lecturers can maximize class engagement by using surveys and polling tools, which can be synchronously incorporated.

Further, by offering video-based lectures, national speakers who usually would not have been able to speak due to travel restrictions are able to do so with incredible ease. Programs can share live or recorded lecture content across multiple institutions, enhancing further dissemination of knowledge. As the pandemic evolves, video-based platforms provide a unique solution to POCUS didactic education. This may provide a new opportunity for more active participation through national organizations such as SAEM, ACEP, AIUM, and SCUF.

**Independent Learning**

A vital component of all ultrasound education is self-directed learning. This has never been as important when faced with COVID-19. Online videos such as 5 Minute Sono12 and/or paid subscriptions to Ultrasound Learning Academy13 can mitigate the inability to practice educational POCUS outside of clinical work. Tangible, measurable goals will be needed to assess the efficacy of self-directed learning. For fellows, the Advanced Emergency Medicine Ultrasound Examination14 will be an important standard that will ensure competence regardless of training environment.

**CONCLUSION**

COVID-19 has changed point-of-care ultrasound education for fellows and residents. The use of tele-ultrasound, virtual didactics, asynchronous learning and has the potential to augment point-of-care ultrasound education and facilitate clinical practice, even in this period of a global pandemic. Future global crises may also disrupt education; swift adaptation of these
guidelines to address disruptions while also maintaining excellence in point-of-care ultrasound education is highly encouraged.

References