Knowing Your Team: Rapid Assessment of Residents and Fellows for Effective Horizontal Care Delivery in Emergency Events

Bradley Dennis, MD*
Alexandra Highet, BA*
Daniel Kendrick, MD, MA
Laura Mazer, MD, MHPE
Sean Loiselle, BS
Hoda Bandeh-Ahmadi, PhD
Tanvi Gupta, ME
Kenneth Abbott, MS
Jarrett Lea, BS
Thu Dang, BS, BA
Mischon Ramey, MS
Brian George, MD, MA
Kyla Terhune, MD, MBA

ABSTRACT

Background Horizontal care, in which clinicians assume roles outside of their usual responsibilities, is an important health care systems response to emergency situations. Allocating residents and fellows into skill-concordant clinical roles, however, is challenging. The most efficient method to accomplish graduate medical education (GME) assessment and deployment for horizontal care is not known.

Objective We designed a categorization schema that can efficiently facilitate clinical and educational horizontal care delivery for trainees within a given institution.

Methods In September 2019, as part of a general emergency response preparation, a 4-tiered system of trainee categorization was developed at one academic medical center. All residents and fellows were mapped to this system. This single institution model was disseminated to other institutions in 2020 as the COVID-19 pandemic began to affect hospitals nationally. In March 2020, a multi-institution collaborative launched the Trainee Pandemic Role Allocation Tool (TPRAT), which allows institutions to map institutional programs to COVID-19 roles within minutes. This was disseminated to other GME programs for use and refinement.

Results The emergency response preparation plan was disseminated and selectively implemented with a positive response from the emergency preparedness team, program directors, and trainees. The TPRAT website was visited more than 100 times in the 2 weeks after its launch. Institutions suggested rapid refinements via webinars and e-mails, and we developed an online user's manual.

Conclusions This tool to assess and deploy trainees horizontally during emergency situations appears feasible and scalable to other GME institutions.

Introduction

Over the past 2 decades, disaster events in the United States have necessitated rapid coordination and mobilization of our hospital workforce. Much of the planning for these disasters has centered around mass casualty incidents.[1–4] However, the 2015 Ebola virus outbreak reinforced the importance of incorporating pandemic events within health care disaster planning,[5–7] and the 2020 COVID-19 pandemic has again proven the need for effective systems-level preparations. Without established plans and logistical support, hospitals may struggle to identify personnel to fill vital roles in emergencies.

Residents and fellows have added substantial value to previous emergency response situations for several reasons.[8,9] These physicians represent a sizeable, skilled workforce that is easily accessible, rapidly mobilized, and often geographically clustered. They are also adept at navigating electronic health record systems, allowing them to transfer to other roles and locations with minimal additional training. Working on different services and in different departments throughout a hospital system affords them an intimate working knowledge of hospital policies, geography, and other personnel. This is a distinct benefit when compared to locum or other transient clinicians who would require orientation and training. Lastly, and perhaps most importantly, trainees are an intelligent and high-functioning group, are well-educated, and can be retrained quickly. Some are independently licensed, and most fellows are board-eligible or board-certified, allowing for their emergent credentialing if necessary.

An efficient method to mobilize trainees during emergency situations has not been studied. Therefore, in September 2019, we sought to create an emergency

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*Denotes co-first authors.

response system to rapidly communicate with and horizontally deploy them for a variety of disasters. We describe our process and subsequent collaboration with the University of Michigan that allowed for free implementation of this system to support national COVID-19 pandemic response efforts.

What was known and gap
Horizontal care, in which clinicians assume roles outside of their usual responsibilities, is an important health care systems response to emergency situations. An efficient method to mobilize trainees during emergency situations has not been studied.

What is new
A categorization schema that can efficiently facilitate clinical and educational horizontal care delivery for trainees within a given institution.

Limitations
The categorization scheme broadly classifies residents and fellows into only 4 categories and may not reflect the exact needs of a specific disaster response.

Bottom line
A horizontal deployment classification scheme for residents and fellows was disseminated nationally and further refined during the COVID-19 pandemic. It was feasible, acceptable, and may be scalable to institutions of varying sizes.

Methods

Setting and Participants

Vanderbilt University Medical Center (VUMC) is a teaching hospital in Nashville, Tennessee, with 98 Accreditation Council for Graduate Medical Education (ACGME)–accredited programs and 1053 residents or fellows appointed through the graduate medical education (GME) office. All trainees are graduates of allopathic or osteopathic medical programs or their equivalent, and 22% have Tennessee medical licenses. Approximately 25% are in fellowships and are board-certified or board-eligible in their core specialties such as surgery, pediatrics, anesthesiology, or medicine.

In September 2019, the VUMC GME office brought together key stakeholders with expertise in disaster management and emergency preparedness to discuss institutional needs and determine relevant roles that trainees might fill in a health care emergency. These stakeholders determined the need for an inventory of trainee patient care skill sets according to specialty and postgraduate year (PGY) level.

Intervention

A VUMC workgroup was subsequently formed and set out to develop a categorization system that would allow the GME office, GME administrators, and the hospital command center to have a rapid assessment of trainee workforce capabilities. The workgroup discussed different models of care delivery and referred to them as *vertical* and *horizontal*. *Vertical care delivery* is intradepartmental and can be coordinated quickly and easily. *Horizontal care delivery*, in contrast, refers to a comprehensive, institution-wide approach to mobilizing the existing workforce to meet immediate needs. Horizontal care delivery must consider clinician skills across departments and requires not only immediate action but also a response that would be efficient, robust, and sustainable.

Development of Classification Schema

Residents and fellows were broadly categorized by core specialty areas (medicine, surgery, pediatrics, anesthesia) and then, within each specialty, by clinical skill level corresponding to expected ACGME Milestone advancement by PGY. We set a 4-tiered ranking system: Independent, Advanced, Basic, and Foundation. This system was designed to disassociate skills from individual trainees and instead advance trainees yearly as they advance in their programs.

The workgroup also determined the need for additional medical care categories beyond the 4 broad specialty areas, given patient and health system needs during an emergency. A Family Support category was created as previous incidents have identified the need to provide support for both patient families and health care workers.[10,11] Certain medical specialties were also identified as having unique skill sets such as radiograph interpretation, laboratory analysis, and anesthesia administration and were thus grouped into Specialized Services. Finally, an Intensive Care Unit category was created to account for critical care skills for both adult and pediatric patients.

Trainees were categorized based on their ACGME Milestone level and assumed skill set on July 1 of a given year. Although they are certainly more advanced in March of any given academic year than July, the system was designed to be operational at any time point and for any emergency context. Thus, those trainees not in Independent, Advanced, Basic, or Specialized skill categories on July 1 (eg, first-year residents who have just entered a program and must be under direct supervision) can augment nonclinical tasks essential to patient care (such as transport, central supply, meal service, etc) and were therefore assigned to the Foundation category. TABLE 1 depicts how these 4 skill categories were then linked to trainee disaster roles.

Institutional GME Assessment

Next, an institutional GME assessment was performed. The VUMC GME office e-mailed all 98

TABLE 1
Trainee Skill Categorizations Mapped to Clinical Roles Relevant to Disaster Response

Skill Categorization	Clinical Role	Definition
Independent	Medicine, surgery, pediatrics, or anesthesia	Can provide *independent care*: board-certified (or board-eligible) in 1 core specialty and could function independently if not still in training.
Advanced (core specialty)	Medicine	Can provide *advanced medical care*: has completed all/most of an internal medicine residency, could manage a ward floor of 20 to 30 patients with a team of junior residents and other care clinicians with indirect supervision.
	Surgery	Can provide *advanced surgical care*: can assist in any operation and/or independently open and close major body cavities with indirect supervision.
	Pediatrics	Can provide *advanced pediatric care*: has completed all or most of a pediatrics residency, could manage a ward floor of 20 to 30 patients with a team of junior residents and other care clinicians with indirect supervision.
Advanced (skill set)	Family support	Can provide *advanced family support*: can independently function by providing advanced counseling services and assistance to patients' families in a crisis.
	Specialized services	Can provide *advanced specialized services*: can provide independent reading of radiographs, independent laboratory analysis, anesthesia administration, etc.
	ICU–adult	Has significant *adult medical or surgical ICU experience:* can manage ventilators and critically ill adult patients with indirect supervision.
	ICU–pediatrics/neonatal	Has significant *pediatric medical or surgical ICU experience:* can manage ventilators and critically ill pediatric patients with indirect supervision.
Basic	Medicine	Can provide *basic medical care*: can provide general first aid with indirect supervision but cannot provide advanced medical or care for adults or children (as noted above).
Foundation	Various	Cannot perform independent services as noted above, but could help transport patients, serve meals, deliver supplies, etc.

Abbreviation: ICU, intensive care unit.

program directors in December 2019, with explanations of assessment goals, the categorization schema, and a survey requesting that they confirm the classification assigned to their trainees. As aforementioned, program directors were instructed to assume the date to be July 1 of any year, considering expected Milestone progression. With 100% participation and 100% of trainees categorized, we obtained a cross-sectional picture of our institution's GME workforce capabilities.

Rapid Communication System Implementation

Previous disasters such as the Boston Marathon bombing have led to shutdowns of cellular communication systems in affected areas.[2,12,13] As a result, a reliable and rapid means of communication is critical in disaster response. VUMC utilizes a mass notification platform (Everbridge Critical Event Management, Pasadena, CA) for time-sensitive situations such as mass casualty incidents and inclement weather. Through this platform, VUMC can send information in several formats (text, phone call, or e-mail) to all employees in seconds. Message groups can also be created to transmit specific updates to a subgroup of employees. In January 2020, trainees were allocated into message groups based on their skill categorization and year of training. This allows the GME office to centrally and rapidly mobilize trainees with specific skills or experience levels depending on the needs of the hospital.

Multi-Institutional Implementation During COVID-19 Pandemic

Recognizing that all institutions were facing potential surges in patient admissions due to the COVID-19 pandemic, the VUMC designated institutional official (DIO) shared the VUMC model via a listserv for the Association of Program Directors in Surgery in March 2020. The DIO was subsequently approached by

TABLE 2
Categorization of Physician Clinical Roles, Specific to the COVID-19 Pandemic

Clinical Role	Definition
ICU attending	*Board certified in critical care*: able to provide supervision and coordination for medical or surgical intensive care delivery, can manage multiple critical care teams lead by non–critical care trained ICU attending extenders.
ICU attending extender	*Non-board certified in critical care*: faculty/fellow able to provide supervision and coordination of a single medical or surgical intensive care team. Has significant medical, surgical, or pediatric intensive care experience in training; can manage ventilators and critically ill patients with indirect supervision.
ICU resident/APP	*Can provide indirectly supervised medical or surgical intensive care*: has had significant medical or pediatric intensive care experience in training; can manage ventilators and critically ill patients with indirect supervision.
ICU intern	*Can provide directly supervised medical or surgical intensive care or team support*: some exposure to intensive care patients as a trainee, familiarity with the ICU environment, but will not be expected to independently manage ventilators or perform bedside procedures.
Floor attending	*Board certified in medical/surgical specialty*: able to provide supervision and coordination for inpatient medical care delivery—has had significant hospital medicine in training; can manage ventilators and critically ill patients with indirect supervision.
Floor resident/APP	*Can provide indirectly supervised medical care*: has completed all/most of an internal medicine/surgery residency, can supervise triage/screening.
Floor intern	*Can provide directly supervised medical care*: has completed part of an internal medicine/surgery residency, can participate in triage/screening.
Procedure attending	*Board certified in a procedural subspecialty*: can supervise a team specialized in performance of bedside procedures such as central line, arterial line placement.
Procedure resident	*Can perform indirectly supervised bedside procedures*: has significant experience with central line, arterial line placement.
Airway attending	*Board certified in an airway-related subspecialty* (anesthesia/otolaryngology/critical care): can supervise a team specialized to perform intubations and complex airway management.
Airway resident	*Can perform indirectly supervised intubation*: has had significant training in airway management.
ED triage/screen	*Can perform basic triage/disease screening* in ED/ambulatory setting.
Nursing assistant	*Can assist nursing with limited clinical duties* such as patient vitals, intake screening, ambulation, hygiene, etc.
Care partner	*Cannot perform independent services* as noted above, but could help transport patients, serve meals, deliver supplies, etc.
Respiratory therapist	*Can function in the role of respiratory therapist* by assisting with ventilator management and application of noninvasive ventilation/oxygenation therapies.

Abbreviations: ICU, intensive care unit; APP, advanced practice provider; ED, emergency department.

colleagues at the Center for Surgical Training and Research (University of Michigan) and the Procedural Learning and Safety Collaborative who expressed interest in adapting the tool to be specific to the COVID-19 pandemic. The COVID Staffing Project,[14] a multi-institutional collaborative, was immediately formed to implement this system locally at VUMC as well as support GME programs broadly.

To translate the VUMC classification system into a scalable solution for other institutions, an interdisciplinary team of physicians, data analysts, engineers, software developers, and social scientists adapted the VUMC schema and trainee disaster roles into a matrix of COVID-specific Response Roles (TABLE 2). Attending physician as well as trainee roles were categorized because some hospitals may choose to put emergently credentialed fellows into attending physician roles. This team then created the Trainee Pandemic Role Allocation Tool (TPRAT)[14] and made it available for free download on March 31, 2020. The TPRAT is a layered spreadsheet built in Microsoft Excel (version 16.35, Redmond, WA) that automates the organization of trainees into COVID-19 clinical roles based on their specialty and year of training. An overview of how to use the TPRAT is provided in TABLE 3, FIGURE 1, and FIGURE 2. We estimate that approximately 300 hours of collaborative work went into the development of this tool.

Outcomes and Analysis

The emergency response system was intended for use during 3 disaster scenarios: (1) mass casualty; (2) environmental or structural disaster; and (3) pandemic. In March 2020, VUMC experienced 2 of

TABLE 3
Trainee Pandemic Role Allocation Tool (TPRAT) Overview

Step	Process
1	Download institution-specific trainee data[a] from the ACGME Accreditation Data System Reports[15] and copy and paste these data into the TPRAT.
2	The TPRAT will map the VUMC classification scheme[a] to trainee specialty and program year and generate spreadsheets of COVID-19 Response Roles.[b]
3	Use these spreadsheets to assign individual trainees into clinically appropriate roles.

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; VUMC, Vanderbilt University Medical Center.
[a] See FIGURE 1.
[b] See FIGURE 2.

these scenarios: Nashville, Tennessee, was hit by a tornado on the evening of March 3, and the COVID-19 pandemic unfurled in the subsequent weeks. Responding to both situations necessitated selective horizontal deployment of clinicians across VUMC and allowed for initial assessment of the feasibility, acceptability, and usefulness of the system. The tool was also shared nationally in the United States.

This work was considered a quality improvement initiative and as such was not reviewed by the Vanderbilt University Medical Center Institutional Review Board.

Results

VUMC Experience

The horizonal deployment model was referenced to determine which of our trainees should remain in reserve during the weeks prior to a potential COVID-19 surge. It was subsequently used to create proactive call schedules for procedure teams as well as outpatient and intensive care unit surge teams to ensure supervision, maximize educational value, and oversee transfer of skills. As the framework had already been established, it was very easy to implement. The DIO added a system in which program directors could indicate presence or absence of trainees in a shared folder for real-time assessment of available trainees. As all program directors had been directly involved in its creation and understood the basics even before the COVID-19 pandemic, the implementation was very well received. Additionally, because the framework had been established, efforts could be focused on communication regarding the well-being of trainees.

National Experience

When VUMC shared the model via an ad hoc e-mail listserv with 32 DIOs during the week of March 23, 2020, several requests were made to review the classification scheme. Approximately 7 DIOs from national institutions participated in an initial informal webinar. Several subsequent individual videoconferences and conversations were requested, and at least 2 other institutions adapted the original model.

Two weeks after the online launch of the TPRAT (March 31, 2020), the site was shared via a listserv for the Group on Resident Affairs of the Association of American Medical Colleges. The COVID Staffing Project website has received more than 100 visitors as of April 14, 2020. Administrators have asked questions about the tool via informational webinars or e-mail, and we have incorporated several changes to the TPRAT based on their feedback. As one example, the entire list of ACGME subspecialty residencies was added to the input worksheet while preserving the capability to enter non-ACGME trainee data, which improves the TPRAT's customizability for all institutions. Other improvements were also made to the tool and its accompanying User Guide.[16] Finally, we refined the TPRAT to work synergistically with other tools, including those of

Program Specialty	Year in Program	Specialty/Subspecialty	Condensed Specialty Type	Condensed Specialty Code
Pediatrics	2	Pediatrics	Pediatrics	18
Pediatrics	2	Pediatrics	Pediatrics	18
Plastic surgery	3	Plastic surgery	Non Crit Med/Surg Fellow	28
Internal medicine	1	Internal medicine	Internal Medicine/Family Medicine	7
Internal medicine	1	Internal medicine	Internal Medicine/Family Medicine	7
Hematology and medical oncology	1	Hematology and medical oncology	Non Crit Med/Surg Fellow	28
Pathology-anatomic and clinical	2	Pathology-anatomic and clinical	Pathology	17
Internal medicine	2	Internal medicine	Internal Medicine/Family Medicine	7
Internal medicine	1	Internal medicine	Internal Medicine/Family Medicine	7
Psychiatry	2	Psychiatry	Psychiatry	21
Neuroradiology	1	Neuroradiology	Non Med/Surg Fellow	29
Plastic surgery	3	Plastic surgery	Non Crit Med/Surg Fellow	28
Internal medicine	2	Internal medicine	Internal Medicine/Family Medicine	7

FIGURE 1
Screenshot of Input Spreadsheet for the Trainee Pandemic Role Allocation Tool

Click to Update

Condensed Specialty	PGY Minimum	PGY Maximum	Floor Resident / APP Maximum	Floor Intern Maximum	Respiratory Therapist Maximum	ICU Attending Extender Maximum	ICU Resident / APP Maximum	ICU Intern Maximum	ER Triage / Screen Maximum	Procedure Resident Maximum	NA / LPN Maximum	Care Partner Maximum	Airway Team Resident Maximum
Anesthesiology	1	4	0	19	36	0	54	19	19	54	19	19	54
Child Neurology	1	5	0	9	0	0	0	9	9	0	9	9	0
Dermatology	1	4	0	14	0	0	0	14	8	0	8	8	0
Diagnostic Radiology	2	5	0	21	0	0	0	0	0	0	21	21	0
Emergency Medicine	1	3	0	26	0	0	0	0	26	26	0	0	26
General Surgery	1	5	23	37	0	0	23	37	37	23	0	0	0
Internal Medicine/Family Medicine	1	4	44	95	0	0	44	95	95	0	139	139	0
Internal Medicine/Pediatrics	1	4	12	11	0	0	0	23	23	0	11	11	0
Interventional Radiology-Integrated	1	5	0	0	0	0	0	0	0	5	0	0	0
Neurology	1	4	0	26	0	0	0	26	26	0	26	26	0
Neurosurgery	1	7	0	6	0	0	13	19	19	7	12	12	0
Obstetrics and Gynecology	1	4	12	12	0	0	0	24	24	0	24	24	0
Ophthalmology	2	4	0	10	0	0	0	10	10	0	10	10	0

Click to Update

Condensed Specialty	Floor Resident / APP	Floor Intern	Respiratory Therapist	ICU Attending Extender	ICU Resident APP	ICU Intern	ER Triage / Screen	Procedure Resident	NA / LPN	Care Partner	Airway Team Resident
Anesthesiology	0	19	36	0	54	19	19	54	19	19	54
PGY 1	0	19	0	0	0	19	19	0	19	19	0
PGY 2	0	0	0	0	18	0	0	18	0	0	18
PGY 3	0	0	18	0	18	0	0	18	0	0	18
PGY 4	0	0	18	0	18	0	0	18	0	0	18
PGY 5	0	0	0	0	0	0	0	0	0	0	0
PGY 6	0	0	0	0	0	0	0	0	0	0	0
PGY 7	0	0	0	0	0	0	0	0	0	0	0
PGY 8	0	0	0	0	0	0	0	0	0	0	0
Child Neurology	0	9	0	0	0	9	9	0	9	9	0
PGY 1	0	3	0	0	0	3	3	0	3	3	0
PGY 2	0	3	0	0	0	3	3	0	3	3	0
PGY 3	0	3	0	0	0	3	3	0	3	3	0
PGY 4	0	0	0	0	0	0	0	0	0	0	0
PGY 5	0	0	0	0	0	0	0	0	0	0	0
PGY 6	0	0	0	0	0	0	0	0	0	0	0
PGY 7	0	0	0	0	0	0	0	0	0	0	0
PGY 8	0	0	0	0	0	0	0	0	0	0	0

FIGURE 2
Screenshots of Output Spreadsheets for the Trainee Pandemic Role Allocation Tool

the COVID Staffing Project, to maximize the integration of trainees into hospitals' broader COVID-19 response efforts.

Discussion

This model for horizontal deployment of trainees during a variety of emergency situations, which categorized trainees into Independent, Advanced, Basic, and Foundation categories, was acceptable during the COVID-19 pandemic at 1 institution. With multi-institutional input, the instrument was refined and developed into a COVID-19 specific tool (the TPRAT) for categorizing trainee specialties, with broad interest nationally.

Several other issues must be considered in horizontal care delivery, particularly by trainees. Safety and educational value must be upheld alongside high-value patient care. Trainees should always be in the most relevant educational and clinical roles possible, with the goal of maximizing learning and contribution during a disaster if they are horizontally deployed. GME programs should look to the ACGME for guidance, an example being the "Stage 3: Pandemic Emergency Status Guidance" that the organization published during the COVID-19 pandemic.[17] In this guide, nonnegotiable considerations were outlined, including the need to continue to provide adequate resources and training, adequate supervision, and adherence to work hours.

Process sustainability is an important long-term consideration. Since skill categorization was based on expected milestones associated with each PGY, the categorization of each individual resident can be advanced as the resident matriculates through training, creating a durable process. Additionally, the TPRAT output spreadsheets can be easily modified, allowing program directors, administrators, or command center leaders to track trainee availability and adjust deployment accordingly as emergent situations such as the COVID-19 pandemic evolve.

There are some limitations to this system. The categorization scheme broadly classifies residents and fellows into only 4 categories and may not reflect the exact needs of a specific disaster response. For example, the relative lack of emphasis on surgical services during a COVID-19 pandemic response plan would not align with needs following a mass shooting, and thus each disaster may require customization. Also, this process categorizes residents on their level of training, rather than their

individual performance, which may overestimate or underestimate their skills. We have shown that the categorization process has wide appeal, but we have not examined actual patient or educational outcomes, in comparison to other strategies to horizontally deploy trainees. As the original categorization scheme was developed for a large institution, the generalizability to GME institutions with low numbers of trainees or residency programs is unknown.

Since implementation of the classification scheme at VUMC, proactive schedules for intensive care unit surges and procedure teams have been created 2 to 4 weeks in advance, with daily discussions regarding program pressures and trainee availability. How residents are deployed horizontally during the pandemic, versus schedules generated from the classification scheme, should be followed during the pandemic. A model for horizontal redeployment has been created for faculty, with data from a skills survey, and its implementation should be followed as well.

Conclusions

This horizontal deployment classification scheme for residents and fellows, developed initially for one large institution, was disseminated nationally and further refined during the COVID-19 pandemic. The tool appears feasible and widely acceptable and may be scalable to institutions of varying sizes.

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Bradley Dennis, MD*, is Interim Chief, Division of Trauma and Surgical Critical Care, and Associate Professor, Department of Surgery, Vanderbilt University Medical Center (VUMC); **Alexandra Highet, BA*,** is a Fourth-Year Medical Student, University of Michigan Medical School; **Daniel Kendrick, MD, MA,** is Clinical Instructor of Surgery, Department of Surgery, Michigan Medicine; **Laura Mazer, MD, MHPE,** is Assistant Professor of Surgery, Michigan Medicine; **Sean Loiselle, BS,** is Full Stack Developer, Procedural Learning and Safety Collaborative; **Hoda Bandeh-Ahmadi, PhD,** is Director of Social Research, Center for Surgical Research and Training, Department of Surgery, Michigan Medicine; **Tanvi Gupta, ME,** is Big Data Analyst, Center for Surgical Research and Training, Department of Surgery, Michigan Medicine; **Kenneth Abbott, MS,** is a Fourth-Year Medical Student, University of Michigan Medical School; **Jarrett Lea, BS,** is Senior Application Developer, Office of Graduate Medical Education, VUMC; **Thu Dang, BS, BA,** is Associate Application Developer, Office of Graduate Medical Education, VUMC; **Mischon Ramey, MS,** is Senior Application Developer, Office of Graduate Medical Education, VUMC; **Brian George, MD, MA,** is Assistant Professor of Surgery, Department of Surgery and Director, Center for Surgical Training and Research, Michigan Medicine; and **Kyla Terhune, MD, MBA,** is Associate Professor of Surgery and Anesthesia, Vice President for Educational Affairs, Associate Dean for Graduate Medical Education, and Accreditation Council for Graduate Medical Education/National Resident Match Program Designated Institutional Official, Department of Surgery, VUMC.

*Denotes co-first authors.

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Corresponding author: Kyla Terhune, MD, MBA, Vanderbilt School of Medicine, Office of Graduate Medical Education, 209 Light Hall, 2215 Garland Avenue, Nashville, TN 37232, 615.322.2065, fax 615.322.0689, kyla.terhune@vumc.org

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