



WestJEM

Volume 22, Number 1, January 2021

Open Access at www.westjem.com

ISSN 1936-900X

Western Journal of Emergency Medicine: Integrating Emergency Care with Population Health Indexed in MEDLINE



Special Issue in Educational Research and Practice



UC Irvine Health



A Peer-Reviewed, International Professional Journal



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Integrating Emergency Care with Population Health

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Emergency medicine is a specialty which closely reflects societal challenges and consequences of public policy decisions. The emergency department specifically deals with social injustice, health and economic disparities, violence, substance abuse, and disaster preparedness and response. This journal focuses on how emergency care affects the health of the community and population, and conversely, how these societal challenges affect the composition of the patient population who seek care in the emergency department. The development of better systems to provide emergency care, including technology solutions, is critical to enhancing population health.

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The *WestJEM* Special Issue in Educational Research & Practice couldn't exist without our many reviewers. To all, we wish to express our sincerest appreciation for their contributions to this year's success. Each year a number of reviewers stand out for their (1) detailed reviews, (2) grasp of the tenets of education scholarship and (3) efforts to provide feedback that mentors authors on how to improve.

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Margaret Goodrich, MD[‡]

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Adam Kellogg, MD[‡]

Douglas Franzen, MD, MEd^{||}

*University of Michigan Medical School, Department of Emergency Medicine, Ann Arbor, Michigan

[†]Louisiana State University Health Shreveport, Department of Emergency Medicine, Shreveport, Louisiana

[‡]University of Massachusetts Medical School – Baystate Health, Department of Emergency Medicine, Springfield, Massachusetts

[§]Loma Linda University Medical Center, Department of Emergency Medicine, Loma Linda, California

[¶]Penn State Health, Milton S. Hershey Medical Center, Department of Emergency Medicine, Hershey, Pennsylvania

^{||}University of Washington, Department of Emergency Medicine, Seattle, Washington

Section Editor: Abra Fant, MD

Submission history: Submitted September 3, 2020; Revision received November 1, 2020; Accepted November 9, 2020

Electronically published December 14, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.49709

The rising numbers of residency applications along with fears of a constrained graduate medical education environment have created pressures on residency applicants. Anecdotal evidence suggests substantial challenges with the process of offering residency interviews. This narrative review is designed to identify and propose solutions for the current problems in the process of offering residency interviews. We used PubMed and web browser searches to identify relevant studies and reports. Materials were assessed for relevance to the current process of distributing residency interviews. There is limited relevant literature and the quality is poor overall. We were able to identify several key problem areas including uncertain timing of interview offers; disruption caused by the timing of interview offers; imbalance of interview offers and available positions; and a lack of clarity around waitlist and rejection status. In addition, the couples match and need for coordination of interviews creates a special case. Many of the problems related to residency interview offers are amenable to program-level interventions, which may serve as best practices for residency programs, focusing on clear communication of processes as well as attention to factors such as offer-timing and numbers. We provide potential strategies for programs as well as a call for additional research to better understand the problem and solutions. [West J Emerg Med. 2021;22(1)1-6.]

INTRODUCTION

It is increasingly apparent that the process by which interview offers are distributed to medical students in the residency application process is becoming a source of substantial stress to participants and a disruption to their educational environment and personal life. Little direct data exists on the extent of the problem and its impact; however, extensive anecdotal evidence exists and clearly resonates with match participants. These anecdotes from both traditional peer-reviewed and online sources cite problems such as avoiding or compromising participation in educational

activities, compromised personal life, and involving multiple friends and family members to manage responses.¹⁻⁴ While evidence is mixed as to the predictive value of the residency interview for future performance, it is heavily weighted in candidate decisions, and serves as a de facto gatekeeper for inclusion on a program's rank order list and potential placement at that residency program.^{5,6}

Over the past decade and particularly during the past five years, there has been a steady upward trend in the number of residency applications per medical student applicant. US allopathic medical school graduates across all specialties selected

have increased from 49 applications in 2014 to 60 in 2018.⁷ Osteopathic graduates in a similar time frame have jumped from 38 to 62 applications.⁷ Residency programs have concurrently experienced a similar rise in application numbers during the same time period, increasing from just over 900 per program to over 1000 in 2016 before levelling off in subsequent years.⁸

Preliminary Electronic Residency Application Service (ERAS) data from the 2019 application cycle continues to show upward trends in application numbers.⁹ This increase in application numbers has not been reflected in a change in match rates.^{10,11} There also has not been a significant change in the number of programs on the rank order list (ROL) list required to successfully match among matched applicants.¹¹⁻¹³ As ROL positions are a close surrogate for interviews completed this would argue that the number of interviews needed to successfully match has not increased in proportion to the increased numbers of applications.¹⁴ However, the perception of an increasingly competitive residency match environment and a desire to avoid the catastrophic “unmatched” state is likely driving application behaviors.¹⁵

Several proposals to structurally modify the match and application process including limits on numbers of interviews are currently being offered; however, large-scale reform will take time.¹⁶⁻¹⁹ These proposals include strategies such as a multistage match process and preference signaling systems but have not progressed beyond the concept stage. There are potentially factors related to residency interview scheduling practices that reside within the residency program’s control and could be modified to decrease the anxiety and potential disruption to applicants’ lives and educational undertakings.

Objectives

It was our objective with this narrative review to identify the current problems in the process of offering residency interviews, summarize the available literature on the subject, and provide potential solutions from the literature and expert opinion of the authors. Our goal is to provide residency programs with potential strategies to minimize the disruptive nature of this essential process.

METHODS

The author group consisted of emergency medicine (EM) faculty with extensive collective experiences as leaders in undergraduate and graduate medical education (UME-GME). The authors were drawn from members and leadership of the Application Process Improvement Committee convened by the Council of Residency Directors in Emergency Medicine (CORD) and have all been involved in specialty-based initiatives to address the recent increase in residency application numbers. We identified articles using a search of PubMed using search strategies described in Table 1. Keywords and Medical Subject Headings (MeSH) terms were reviewed in identified articles to inform the parameters of the search and verify appropriateness of our terms. Results included perspective pieces (majority),

Table 1. Search strategy and results regarding the current system of offering interviews to residency applicants

Terms used	Results returned	Results within 2010-2020 timeframe	Relevant results*
Internship and residency and Interview as topic and Offers	16	13	1
Graduate Medical Education and Interviews as topic and Offers	8	7	0
Graduate Medical Education and Interviews as topic	318	238	0
Residency Interview Scheduling	638	330	8
Graduate Medical Education and Interviews as topic and appointment and schedules	9	7	3

*Some publications may be identified in more than one search.

observational studies, survey studies, and literature reviews.

We reviewed articles iteratively and then decided by consensus which were relevant to include; any disagreements were adjudicated through the lead authors (LH and DF). General guidelines for inclusion were a focus on the actual interview offer or scheduling process and not on the structure of the day itself, the applicant selection process, or interview outcomes. While our focus was on EM, we screened literature from outside of EM and included articles if they dealt broadly with issues rather than specialty-specific considerations (eg, timing of interviews within a specialty). In addition, the articles had to deal with the United States’ residency match environment. Given the dynamic nature of the process and emerging concerns, we limited our searches to materials within the past 10 years (approximately 2010-2020) to make them relevant to the current day processes. The reference lists of identified articles were also reviewed for potential missed publications with three additional relevant publications (all commentaries and perspective pieces) identified. Due to a paucity of relevant literature within PubMed, we also used similar search terms for web searches using the Google search engine for relevant information and returned multiple blog and forum postings relevant to the topic. These were used to further inform this review. We collectively reviewed the identified literature and developed broad thematic categories through iterative discussion to achieve consensus. No institutional review board review was required due to the absence of human subject involvement.

RESULTS

There is limited literature evaluating the extent of the problem regarding the current practice of residency interview offers. Overall, the quality of the literature is low, consisting of individual perspectives with occasional single-site or single-specialty studies addressing limited facets of this question. We identified several areas of challenge within the process. These themes include the following: 1) uncertain time from application submission to release of interview offers; 2) disruption caused by release of interview offers; 3) overextending interview offers more than interview slots available; 4) lack of clarity with regard to waitlist/rejection status; 5) interview scheduling mechanisms; and 6) couples match coordination.

DISCUSSION

Through the literature identified, we classified the issues representing the areas of challenge in the interview scheduling process. We discuss these areas below and attempt to identify potential program-level interventions that may help ameliorate the pressures felt by applicants.

Problem 1: Uncertain Time from Application to Interview Offers

One of the first decisions programs make that directly affects applicants is the timing of the interview offer. From the program perspective the process is relatively well defined with application review taking up the majority of time between ERAS submission by the applicant and interview offers weeks later. It is easily understood how narrowing the average field of around 900 applications per program down to the initial number of offers can take up this entire period of time.⁷ However, to the applicant who is undergoing this process for the first time, no such insight is available regarding this time-consuming process required to review applications. The timing of when interview offers are released also varies tremendously among specialties ranging from the day ERAS opens to several months later.^{20,21} There is even substantial variation within specialties as to when individual programs release interviews. Hence, students are unable to anticipate when to make themselves available for scheduling. While similar data does not exist within EM, a 2016 study of vascular surgery websites showed that fewer than 40% made their interview dates available and fewer than 20% provided any information about their selection processes.²⁰ A recent report examining general surgery residencies showed an even worse paucity of information with less than a quarter of websites providing information about interview dates and a mere 3.4% of programs noting interview release dates.²¹

Several potential solutions exist. All of them center around transparency of process and sharing information with the applicant. For example, a consortium of county programs in EM has voluntarily chosen to coordinate a common interview release date.²² While such a coordinated initiative

may pose substantial logistical challenges to coordinate different program and specialty priorities, there are potentially simple, program-level initiatives. Each program could clearly post its interview offer process on its residency website including date(s) of interview-offer releases and whether the program uses rolling offers with multiple rounds of releases and maintains a waitlist. This information is already being collected unofficially via crowdsourcing on message boards such as Reddit.²³

In an older study, DeIorio et al found a high prevalence within EM of offering interviews prior to the release of the Medical School Performance Evaluation (MSPE).²⁴ It is important to note that this study not only reflects the state in a single specialty but was also performed prior to the MSPE release date being moved to October 1 from November 1. The current extent of this practice is unknown and further confounded by the delayed opening of ERAS caused by the academic disruptions from the COVID-19 pandemic. To level the playing field between applicants, EM programs could collectively agree to only review applications when all data is available, including the MSPE. There may, however, be specific circumstances where early review or interview without a full application are appropriate such as when applicants are known to the program (eg, home medical school or students on a visiting rotation).

Problem 2: Disruption Caused by Release of Offers

The “first come, first served” model of interview invitations has led to adaptive but dysfunctional applicant behaviors to ensure that they are immediately available to respond when interview offers are released. Students describe finding all available interview spots filled, despite responding to offers within minutes.^{4,25} Such reports create immense anxiety among applicants, to the point of potentially disrupting patient care activities.¹ Students factor the need to be available into their fourth-year schedule, including avoiding rotations with potentially poor internet service, or surgical rotations where operative time impedes them from responding quickly to an offer. Some literature shows students altering their day-to-day routine such that they are readily available to respond to interview invitations. For example, Sinnott and Johnson describe that “we kept our phones perched precariously on the bathroom sink while showering. We would immediately pull over to the side of the road if our phones vibrated in the car.”²⁴ Friends and family members are also affected when they are enlisted to help monitor phones and email accounts.²⁷ Such behaviors are, unfortunately, understandable responses to the current system of interview offers.

An obstetrics and gynecology residency has proposed a model to provide applicants a clear window to respond to interview offers with a recommendation of a minimum interval of 48 hours.⁴ Within EM, Klein et al described a two-phase strategy of first informing an applicant of their interview offer and the date and time of availability for online

scheduling, followed by opening of the online scheduling system at a time designed to minimize interference with personal life and clinical/school obligations. The authors, however, did not provide any outcomes data related to this approach.²² Such strategies allow students not only time to respond but also time to consider the offer, potentially limiting “interview hoarding” and students accepting an interview simply because they are unsure whether they will get other offers. However, both strategies require programs to send out only as many invitations as they can accommodate.

Programs may consider these models as interventions to decrease the disruption caused by the current method of interview offers. Clear, advance information for applicants regarding when interviews offers will be released, whether this applies just to initial offers, or whether a program uses a staged release of offers could be provided. Students could thus ensure they were available for those dates and times. Initiatives on a specialty-level may also promote and publicize universal release dates. Early notification of a definitive rejection may also allow students closure and decrease the number of programs a student needs to monitor.

Problem 3: Imbalance of Interview Offers and Available Positions

The practice of extending more interview offers than actual positions available for interviews creates an increased sense of panic for students that they will be shut out of an interview.^{19,20,21} National Residency Matching Program (NRMP) applicant surveys demonstrate a multispecialty, five-year trend of dramatically increasing application numbers, slowly increasing numbers of interviews attended, and minimally increasing numbers of programs ranked.²⁹⁻³¹ From this, we can extrapolate that applicants must be declining significantly more interview offers than previously. There is a dearth of data from programs regarding their ratio of interview offers vs actual interview positions available with publications within subspecialties of surgery providing the only hard data available.^{25,26} Anecdotal data is extensive across specialties and suggests that the problem of more interview offers than slots is extensive.^{3,4,27}

Solutions will require new approaches to the interview offer process on the program level. On the offer date, programs may choose to intentionally release no more offers than actual interview slots with the intention of filling the remaining openings later. Programs may also consider a purposefully staged release of offers, to allow a balance between applicant decisions and the program’s desire to have a full interview schedule. The program of one of the authors has several years’ experience with this approach and reports no difficulty filling interview positions with high-quality candidates (oral communication, Laura R. Hopson, MD, January 2020). As noted earlier, regardless of the strategy of interview offers pursued, clear communication about expectations regarding how long the candidate may take to accept or decline the offer is beneficial to the applicants.

Finally, programs may want to consider allowing candidates to place themselves on the waitlist for interview dates that may be currently full.

Problem 4: Lack of Clarity Around Waitlist Status or Rejection

Applicants have significant stress related to when interview offers are extended. There is a distinct challenge for applicants who are waitlisted or rejected. There is little literature dedicated to this topic; however, online student forums contain extensive concerns and frustrations related to these situations, including uncertainty of their status, unknown likelihood of getting an interview from the waitlist, and uncertainty stemming from little to no communication regarding an applicant’s waitlist or rejection status.^{19,32-36}

As with interview offers, residency programs may consider an openly published date for notifying applicants of their position on the waitlist. This communication may include an estimate of the likelihood of receiving an interview offer from the program as well as a time frame in which interview offers may be granted. Sample texts for these communications are included in the Appendix. Similarly, clear communication to applicants who will not receive an interview offer may also be of benefit. Literature from general surgery suggests that very few programs provide this valuable information to applicants.²¹ Ideally, the program could also publish a date for notification of rejection status.

Problem 5: Mechanism of Scheduling

There is substantive work supporting the use of online scheduling programs for residency interviews. Studies by Wills et al and Hern et al in 2015 and 2016 within EM and similar work in surgery by Hoops et al in 2018 showed markedly increased applicant satisfaction and decreased time spent with use of online interview scheduling systems as opposed to direct communication.³⁷⁻³⁹

The exact system is likely unimportant but considerations of functionality, ease of access, and dissemination within the specialty to allow for easy scheduling coordination for applicants should be entertained. In the interests of clarity, the system used should be clearly identified in advance, thus allowing applicants to adjust email spam filters and thereby avoid missed communications.

Problem 6: Couples Match Coordination

The couples match presents a unique set of challenges around interview offers. Coordinating dual careers increases the baseline emotional and financial stress of this process.⁴⁰⁻⁴² NRMP data, however, indicates that couples had a better than 90% success rate of matching each year since 1984, when the couples match first became an option. Additionally, for US seniors, who comprise approximately 69% of couples within the Match, match rates are similar to their non-couple classmates.¹⁰

However, there are some who question whether this data

may be skewed in a practical sense. It is not a large jump to assume that the two members of a couple want to be in proximity to each other. One commentary, describing a married couple who matched at programs far from each other, questions the success the NRMP claims regarding the couples match: “Since coupled applicants are allowed to submit rank lists with limitless match combinations, including those that would place them hundreds of miles apart, this ‘success’ rate fails to account for whether a couple matched within the same geographical area.”⁴³ Any number of factors may impact an applicant participating in the couples match, including desired geographic location, available programs for both applicants within a given location, type of program desired, competitiveness of the partner’s desired specialty, association with a preliminary year, and strength of each applicant’s application.

Advice from applicants who successfully survived the couples match includes having a strategy based on the priorities of both members individually and as a couple.⁴³ Alvin and Alvin also suggest enhanced intra- and inter-institutional communication between programs to which couples are applying regionally, as well as the possibility of a “trigger” notification to the other program if one half of the couple is offered or accepts an interview at the same institution or potentially within a specified region.⁴³ Such mechanisms would have to balance considerations of privacy and convenience.

LIMITATIONS

We fully acknowledge that our study is limited by the lack of evidence-based data available on this topic and draws heavily on anecdotal experiences. In our search, there appears to be more content from the applicant-side than the program-side of the process. This may cause the magnitude of problems to be overemphasized. Further review is likely warranted with a focus on the program perspective in order to balance these initial findings. Our author group represents diverse stakeholders across the UME-GME spectrum but does come from a single specialty, and additional insights may exist in other realms. Finally, while this piece grew out of work done by the Application Process Improvement Committee convened by CORD, the conclusions contained represent the views of the authors and are not intended as a formal policy statement by the organization.

CONCLUSION

Substantial anecdotal evidence exists that the process of offering residency interviews has become disruptive on many levels. Little formal literature exists to categorize the magnitude of the problem. We propose relatively simple interventions at the program level. Many of these echo suggestions starting to be made within other medical specialties.^{21,26} These suggested interventions may help to alleviate challenges for applicants without creating undue burdens on training programs. In addition, with the ongoing

uncertainty and disruption in medical education caused by the coronavirus pandemic and the potential to impact the residency application environment, having programs adopt best practices, particularly those focused around clear communication and expectations, can only benefit the process. We strongly support additional research to define and quantitate the impact of residency interview offer practices and potential interventions.

Address for Correspondence: Laura R. Hopson, MD, University of Michigan Medical School, Department of Emergency Medicine, 1500 E. Medical Center Dr., Ann Arbor, MI 48109. Email: Lhopson@med.umich.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Wellness Interventions in Emergency Medicine Residency Programs: Review of the Literature Since 2017

Arlene Chung, MD, MACM*

*Maimonides Medical Center, Department of Emergency Medicine, Brooklyn, New York

Sarah Mott, MD†

†Emergency Care Consultants, Minneapolis, Minnesota

Katie Rebillot, DO‡

‡LAC + USC Medical Center, Department of Emergency Medicine, Los Angeles, California

Simiao Li-Sauerwine, MD, MS§

§The Ohio State University, Department of Emergency Medicine, Columbus, Ohio

Sneha Shah, MD*

*UCLA David Geffen School of Medicine, Department of Emergency Medicine, Los Angeles, California

Wendy C. Coates, MD¶

¶Oregon Health & Science University, Department of Emergency Medicine, Portland, Oregon

Lalena M. Yarris, MD, MCR||

||Oregon Health & Science University, Department of Emergency Medicine, Portland, Oregon

Section Editor: Abra Fant, MD

Submission history: Submitted June 26, 2020; Revision received November 25, 2020; Accepted November 28, 2020

Electronically published December 19, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.48884

Introduction: Recent research demonstrates burnout prevalence rates as high as 76% in emergency medicine (EM) residents. In 2017 the Accreditation Council for Graduate Medical Education (ACGME) required that all training programs provide dedicated wellness education for their trainees as a requirement for accreditation. We aimed to conduct a systematic review of published wellness interventions conducted in EM residency programs following the implementation of the 2017 ACGME Common Program Requirements change in order to characterized published intervention and evaluate their effectiveness.

Methods: We applied a published approach to conducting systematic reviews of the medical education literature. We performed a search of the literature from January 1, 2017–February 1, 2020. Studies were included for final review if they described a specific intervention and reported outcomes with the primary goal of improving EM resident wellness. Outcomes were characterized using the Kirkpatrick training evaluation model.

Results: Eight of 35 identified studies met inclusion criteria. Most described small convenience samples of EM residents from single training programs and used the satisfaction rates of participants as primary outcome data. Only quantitative assessment methods were used. Studies addressed only a limited number of factors affecting resident wellness. The majority of interventions focused on personal factors, although a few also included sociocultural factors and the learning and practice environment.

Conclusion: There is a relative dearth of literature in the area of research focused on interventions designed to improve EM resident wellness. Furthermore, the studies we identified are narrow in scope, involve relatively few participants, and describe programmatic changes of limited variety. Future directions include an increase and emphasis on multi-institutional studies, randomized controlled trials, qualitative methodology, and opportunities for funded research. [West J Emerg Med. 2021;22(1)7-14.]

INTRODUCTION

Emergency medicine (EM) is a high-stakes, fast-paced specialty requiring quick decision-making with limited

information and often with critically ill patients. High anxiety and concern for poor outcomes influences emotional exhaustion and burnout among emergency physicians.¹ Other factors

that uniquely contribute to burnout in emergency physicians include unpredictable and inconsistent shift schedules²; sleep cycle disturbances²; increasing administrative burden without corresponding autonomy³; and expanding requirements around documentation within the electronic health record (EHR).⁴

Residency is one of the most physically and mentally taxing periods of a physician's career. Compared with attending physicians or medical students, residents score significantly lower on measures of self-care including sleep, exercise, seatbelt use, and overall wellness.⁵ Factors related to burnout begin to take effect during intern year of residency secondary to issues such as duty hours, lack of autonomy, sleep deprivation, and resident mistreatment.⁶⁻⁸ These stressors are further compounded by the need to rapidly develop clinical competence in a setting with complex and sometimes critically ill patients, and low pay relative to hours worked.

In addition, residents have cited that these factors negatively impact their interactions and relationships with patients and have increased frequency of conflict with colleagues.⁹ This potential erosion of personal wellness during training can profoundly impact patient care. Recent studies suggest that EM attending physicians experience burnout rates greater than 70% as defined by the Maslach Burnout Inventory (MBI).¹ EPs in training have been demonstrated to be equally susceptible. In a 2014 study involving residents from eight EM programs, 65% met criteria for burnout.³ A more recent large-scale prevalence study of over 1500 EM residents demonstrated the prevalence of burnout to be even higher, at 76.1%.¹⁰

In 2017 the Accreditation Council for Graduate Medical Education (ACGME) implemented common core program requirements focusing on the psychological, emotional, and physical well-being of residents.¹¹ Current and recently published research has focused primarily on factors contributing to burnout¹²; less is known about the efficacy of interventions to mitigate burnout and improve wellness among EM trainees. Moreover, to date there are no widely accepted uniform recommendations regarding best practices for wellness interventions within residency programs.

We conducted a systematic review of published studies that describe interventions to mitigate burnout or improve wellness in EM training programs in order to characterize the published interventions and evaluate their effectiveness as measured by outcomes. Understanding the current state of the literature and remaining gaps is crucial as educators seek to design and implement programs intended to meaningfully combat burnout and improve wellness among trainees. In this systematic review, we focused our investigation on wellness interventions conducted in EM residency programs following the implementation of the 2017 ACGME Common Program Requirements.

METHODS

Using the methodology described by Cook and West,¹³ we conducted a systematic review of the literature published within the MEDLINE database for articles published between

January 1, 2017– February 1, 2020. This starting date was chosen to coincide with the implementation of the updated 2017 ACGME Common Program requirements that explicitly require programs' support of resident well-being.¹⁴ We used the following search terms: wellness, well-being, burnout, and resilience. Search parameters were limited to EM residents and EM residency programs. Articles describing the results of primary studies of wellness interventions were included for final analysis. We excluded abstracts, opinion pieces, and literature reviews. Bibliographies of relevant articles were reviewed to identify any additional studies.

Articles identified through these search methods were screened by two authors and included for final review if they described a specific intervention and reported a primary outcome that addressed the need for supporting resident well-being in accordance with the ACGME Common Program Requirements Section VI.C.¹⁴ For those that met these criteria, we collected additional details including study design, population, type of intervention, a brief description of the intervention, outcome measure(s), and primary findings. Outcomes were characterized using the Kirkpatrick training evaluation model, which describes outcomes using increasing levels of complexity and potential impact: Level 1 (reaction); Level 2 (learning); Level 3 (behavior); and Level 4 (outcomes). We considered a change in burnout, perceived wellness, or other related outcome as assessed by a tool with existing validity evidence to be a Level 4.

RESULTS

We identified 35 articles on our initial search of the literature. No additional studies meeting the inclusion criteria described above were found after a review of references cited. Eight published studies were included for final review based on our inclusion criteria (Table 1).

An additional six articles described specific wellness interventions but did not provide outcome data, and although these were not considered in our analysis, we have provided them for reference (Appendix 1).

Study Participants

The majority of studies (6 of 8) took place in a single residency program using a convenience sample ranging from 24-58 with an average of 34 residents.¹⁵⁻²⁰ One of the multi-institutional studies included two EM programs (n = 20) and the other included 10 EM programs (n = 437).^{21,22} All of the studies included EM residents at all postgraduate training levels. None of the studies conducted a power analysis to determine the number of participants required to demonstrate a significant effect of the intervention.

Types of Interventions

The most commonly encountered wellness intervention (5 of 8) was a formal, classroom-based initiative.^{15,16,18,20,22} Three of these studies described a year-long curriculum^{16,18,22} and two described a single session.^{15,20} All five provided a broad

Table 1. Primary studies of wellness interventions for residents in emergency medicine.

Primary Author & Year	Title	Population & Design	Type of Intervention	Description of Intervention	Measured Outcome(s)	Kirkpatrick Levels	Main Findings
Calder-Sprackman (2018)	Ice Cream Rounds: The adaptation and evaluation of a peer-support wellness rounds in an emergency medicine resident training program	Case report at single program	Peer support	Voluntary attendance at confidential, peer support sessions (rounds) Led by two peers who received training at Faculty of Medicine's Wellness Program Discussions topics: difficult patient encounters, poor patient outcomes, residency challenges, ethical issues	Overall attendance Feedback from pilot sessions	Level 1	Residents reported rounds were a helpful to discuss important issues with colleagues Peer-support wellness rounds are effective for debriefing and can be easily adopted
Castillo (2018)	Trainees and Faculty Healing Together: A Resident- and Faculty-directed Wellness Initiative for Emergency Medicine Residents	Case study at dual-campus program	Curriculum	All-day wellness initiative "theme day" 2 lectures by EM faculty on existing research and adverse outcomes associated with burnout 5 stations on clinician wellness led by peer resident facilitator and faculty (narrative medicine, burnout assessment, needs analysis, communication strategies) Group social activity Open forum for reflection	Rating of applicability of each station Overall feedback on teaching structure of leaders	Level 1	87% enjoyed structure 75% felt theme day was valuable 74% felt all 5 stations applicable and useful Open responses for combating burnout (stacked shifts, cross-dept communication, faculty mentorship)
Comp (2018)	ED Stories: Online Emergency Medicine Residency Community Building and Wellness Initiative	Case report at single program	Storytelling	Utilized Slack platform to engage residents in a virtual discussion covering difficult situations, patient interactions, tips on how to succeed in challenging circumstances Goal to create "safe space" free of judgement and criticism and to serve as an outlet	Number of participants, interactions, unique written posts, comments, and other reactions Measured after month 1 and in subsequent 5 months	Not applicable	1st month - 54 residents and staff invited, 17 participants (11 residents, 5 attendings, 1 coordinator); 81 total interactions, 10 unique posts, 17 comments, 54 other reactions Next 5 months - 54 invited, 24 participants (15 residents, 8 attendings, 2 coordinators); 131 interactions, 14 posts, 22 comments, 95 other reactions

ED, emergency department; RN, registered nurse; MBI, Maslach Burnout Inventory; EE, emotional exhaustion; PA, personal accomplishment; DP, depersonalization; PGY, post-graduate year; BRWP, Brief Resident Wellness Profile; EM, emergency medicine; PWS, Perceived Wellness Survey.

Table 1. Continued.

Primary Author & Year	Title	Population & Design	Type of Intervention	Description of Intervention	Measured Outcome(s)	Kirkpatrick Levels	Main Findings
Hart (2019)	Does Implementation of a Corporate Wellness Initiative Improve Burnout?	Pre/Post-Assessments at single program	Employee Assistance Program (EAP)	Corporate wellness program (The Happiness Practice) successful with other healthcare providers (e.g. RNs, hospital leadership) implemented during residency conference hours 6 monthly didactic sessions on core principles (be conscious, honor feelings, release control in favor of empowerment, co-create what works now, learn life lessons) Led by the former business executives that founded THP Optional small group evening social discussions between sessions at restaurants 1 st didactic session was 1 hour, subsequent were 15 min sessions (revised per resident feedback on 1 st)	MBI (EE, PA, DP) before and after Reactions after each session Overall satisfaction with program Subjective report of burnout	Level 1 Level 4	Trend toward increased overall burnout scores in EE and DP, improved PA Overall same trends seen in PGY 1, 2, and 3+ years Low overall satisfaction (1.5/5) 17/99 written responses coded as negative (instructors had poor understanding of residency stressors and EM work, not relevant, not tailored toward healthcare professionals, would rather spend conference hours learning about topics related to medicine)
Lefebvre (2018)	Resident Physician Wellness Curriculum: A study of efficacy and satisfaction	Pre/Post-surveys at single program	Curriculum	Multi-faceted wellness curriculum Faculty-derived (F-RWC) and parallel resident-derived (R-RWC) curriculum added after 1 st year	BRWP SF-8 Health Survey, satisfaction scale Measured at baseline, after 1 year F-RWC, after 1 year combined F-RWC and R-RWC	Level 1 Level 4	Significant improvement in wellness with addition of parallel R-RWC to F-RWC Positive satisfaction scores of R-RWC Mental wellness initiatives were best-attended events (monthly music playlists, wellness seminar at annual retreat, Christmas gift donation drive, blood donation drive, Remembrance Day perspective material)
Moriarty (2017)	Improving resident wellness using a moderated faculty panel	Post-intervention survey at single program	Panel discussion	4 EM faculty participated in 30 min panel during resident conference, answered wellness-focused questions submitted by residents	Satisfaction survey	Level 1	23/27 completed survey Majority felt panel was helpful for advice on work-life balance and coping with stressful life events; indicated they wanted more in the future

ED, emergency department; RN, registered nurse; MBI, Maslach Burnout Inventory; EE, emotional exhaustion; PA, personal accomplishment; DP, depersonalization; PGY, post-graduate year; BRWP, Brief Resident Wellness Profile; EM, emergency medicine; PWS, Perceived Wellness Survey.

Table 1. Continued.

Primary Author & Year	Title	Population & Design	Type of Intervention	Description of Intervention	Measured Outcome(s)	Kirkpatrick Levels	Main Findings
Poonja (2018)	Sleep and Exercise in Emergency Medicine: An observational pilot study exploring the utility of wearable activity monitors for monitoring wellness	Pre/Post-survey at single EM program with 2 training sites	Wearable fitness trackers	Residents wore wearable fitness tracker (FitBit) for one 4-week rotation Collected data on sleep quality (number of awakenings), sleep quantity (number of minutes asleep), exercise quality (number of minutes of vigorous activity), exercise quantity (number of daily steps)	PWS FitBit recorded data	Level 1 Level 3 Level 4	No statistically significant correlation between resident PWS scores, sleep interruptions, average daily sleep minutes, daily step count, or average daily active minutes for the sample overall 1 st year residents and residents from years 2-5 reported different median PWS scores of 13.9 and 17.1, respectively Step counts may correlate with wellness in participants in year 1, quantity of sleep may have an association with wellness in participants in years 2-5 Concluded that wearable tracking technology wasn't an effective intervention
Williamson (2019)	The Implementation of a National Multifaceted Emergency Medicine Resident Wellness Curriculum is Not Associated with Changes in Burnout	Pre/Post-evaluation, RCT at 10 EM programs	Curriculum	Year-long multifaceted wellness curriculum implemented at half of sites (5 of 10)	MBI administered at baseline, 6 months, 1 year	Level 4	MBI scores were stable over time, implementation of curriculum was not associated with global changes in burnout When measured as continuous variable, control sites scored lower on depersonalization at baseline and final survey, higher mean personal achievement scores at second survey When measured as dichotomous variable, no differences in global burnout at any time and no change in burnout scores from baseline or over time for control or intervention sites

ED, emergency department; RN, registered nurse; MBI, Maslach Burnout Inventory; EE, emotional exhaustion; PA, personal accomplishment; DP, depersonalization; PGY, post-graduate year; BRWP, Brief Resident Wellness Profile; EM, emergency medicine; PWS, Perceived Wellness Survey.

overview of wellness during residency training and attempted to address multiple facets including work-life balance, stress management, and burnout coping mechanisms. The remaining three interventions included a peer support program,¹⁹ a virtual storytelling platform,¹⁷ and wearable fitness monitors to track sleep, steps, and activity.²¹

Measured Outcomes

Included studies used a variety of previously published measures with existing validity evidence to assess the impact of wellness interventions (Table 2). Two studies used the MBI-HSS^{18,22}; one used the Perceived Wellness Scale²¹; and one used a combination of the Brief Resident Wellness Profile and Short Form Health Survey (SF-8).¹⁶ Many of the studies also used satisfaction surveys to assess participant reactions to the interventions,¹⁵⁻²⁰ and two used a combination of both.^{16,18}

Main Findings

A diverse array of interventions were described in our literature review. Overall, participant satisfaction rates for changes aimed at improving resident wellness were high across all of the studies included for analysis, regardless of the specific intervention employed. Although the specific assessment tools varied, none of the authors demonstrated statistically significant differences between rates of wellness and/or burnout before and after the intervention period. Lastly, none of the studies included in our final analysis received grant support or other funding.

DISCUSSION

While EM as a specialty has responded with large-scale wellness initiatives, such as the American College of Emergency Physicians' Wellness Week and the formation of dedicated wellness committees within major national organizations, there is still a paucity of understanding about interventions employed for individual programs and learners. In our review of the literature since 2017, when the ACGME mandated that programs include wellness-specific programming, we found eight published studies that describe implementation of interventions designed to improve resident wellness in EM residency programs. The majority of studies describe small convenience samples of EM residents from single training programs and used the satisfaction rates of participants as primary outcome data. While the majority of outcomes are modest in size and limited in impact, these studies demonstrate encouraging pilot data to inform larger scale studies.

Expert consensus supports the development of a more comprehensive model in order to effect positive change. One such model proposed by the National Academy of Medicine Model of Clinician Well-Being describes seven important factors: society and culture; rules and regulations; organizational factors; learning and practice environment; healthcare responsibilities; personal factors; and skills and abilities.¹² Only the last two factors are considered intrinsic to the individual. Although the majority of interventions studied

Table 2. Assessment tools used to evaluate intervention effectiveness.

Assessment tool	Description
Brief Resident Wellness Profile ²³	Mood faces graphical rating item and 6-question subscale designed to measure resident's sense of professional accomplishment and mood
Perceived Wellness Scale ²⁴	36-item survey measuring an individual's perception of their own wellness
Short Form Health Survey (SF) ²⁵	8-item abbreviated version (SF-8) of a generic 36-item, health-related quality of life survey instrument
Maslach Burnout Inventory ²⁶	22-item survey measuring burnout along three subscales: emotional exhaustion, depersonalization, lack of personal achievement

focus on individual factors, a few also included sociocultural factors and the learning and practice environment. Aside from the limited number of factors mentioned, none of the interventions addressed systems-based challenges, such as the EHR, clerical burden, initial licensure and maintenance of certification, litigation risk, or regulatory requirements. These are areas that are ripe for additional investigation.

Our review of the literature suggests a need for a more diverse field of interventions that aim to mitigate the risk of burnout and promote resident engagement. The current literature supports a comprehensive and longitudinal focus on physician well-being that begins in residency training and emphasizes environmental factors, more specifically the following: that programs create and employ interventions to promote well-being; enact systems to better recognize depression, stress and burnout among residents; and fortify trainees in building resilience. Supportive experiences and healthy coping skills learned during training produce resilient residents and pave the way for career longevity and professional satisfaction.

High-quality published research studies of measurable outcomes with large samples of learners are needed to inform educators about which wellness interventions improve trainee outcomes. These studies are time and labor intensive, and would be supported and facilitated by dedicated grant funding for wellness research from national organizations and local entities. Our systematic review of wellness initiatives suggests that the next steps toward understanding how to meaningfully impact trainee wellness are to support multi-institutional studies, randomized controlled trials, and qualitative studies to further explore the phenomenon of wellness in medical education, and opportunities for funded research.

LIMITATIONS

The search window of articles published since January 1, 2017, is narrow and we may not have captured relevant wellness

interventions published prior to that date. However, this date is significant as it marks the year when the ACGME Common Program Requirements began to mandate wellness initiatives for residency program accreditation. The goal of this literature review was to identify the highest quality published evidence and is not meant to be a comprehensive review of all interventions. We did not include a review of abstracts or the gray literature, such as conference proceedings, reports, or dissertations, as we wished to capture the best-studied and most effective interventions as reflected in peer-reviewed manuscript publication.

The methodology described within this small pool of literature is limited; thus, we were unable to draw definitive conclusions regarding the overall effectiveness and generalizability of interventions. Although the Kirkpatrick model is widely accepted as a method of categorizing educational outcomes, the level of outcome that matters may vary depending on the study aim. For educational concepts where learner reactions and perceptions are the outcome of interest, Level 1 outcomes may be the “best” outcomes to measure; thus, Kirkpatrick levels are not a definitive hierarchy of quality. The majority of studies described small convenience samples of EM residents from single training programs and used the satisfaction rates of participants as primary outcome data. Additionally, none of the studies we identified primarily used qualitative methods of assessment, which offer a richer understanding of resident experiences and can serve to guide the focus of quantitative studies.

CONCLUSION

Despite the increased attention to EM resident wellness, there currently exists only a modest number of published studies describing wellness interventions for EM residents with variable outcome data primarily focused on participant satisfaction. This review of the literature reflects a need for scholarship of EM resident wellness to extend beyond the current focus on individual factors to an emphasis on environmental factors, and rigorous evaluations of outcomes-driven interventions.

Address for Correspondence: Arlene Chung, MD, Maimonides Medical Center, Department of Emergency Medicine, 4802 Tenth Ave, Brooklyn, NY 11219. Email: Arlene.Chung@gmail.com.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Impact of Resident-Paired Schedule on Medical Student Education and Impression of Residency Programs

Ibrahim Mansour, MD
Sean Dyer, MD
Neeraj Chhabra, MD

Cook County Health and Hospital Systems, Department of Emergency Medicine,
Chicago, Illinois

Section Editor: Jonathan Fisher, MD, MPH

Submission history: Submitted June 15, 2020; Revision received December 11, 2020; Accepted December 14, 2020

Electronically published December 19, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.48761

Introduction: Clinical rotations in emergency medicine (EM) can be challenging for medical students because of the lack of continuity with attending physicians. To overcome this challenge, institutions have started to match a student's schedule with that of a resident, referred to as "paired shifts." We sought to pilot and compare two schedule formats for fourth-year medical students (MS4) – a resident-paired shifts (RPS) and a traditional resident-unpaired shifts (RUS) schedule.

Methods: This prospective, crossover trial included MS4s rotating in the emergency department over four consecutive four-week blocks. Each MS4 was assigned two weeks using the RUS schedule and two weeks with the RPS schedule, alternating the format order each month. At the end of the rotation students were anonymously surveyed regarding the differences in learning experience, their ability to showcase their knowledge and clinical skills, and familiarity with the residency program with the two formats.

Results: The response rate was 47 of 58 students (84%). Respondents indicated that RPS resulted in more teaching time (64.6% RPS vs 8.3% RUS), a better overall educational experience (68.8% RPS vs 8.3% RUS), and a greater ability to showcase their medical knowledge (52.1% RPS vs 6.3% RUS). Additionally, students felt that the program was better able to evaluate them (66.7% RPS vs 10.4% RUS) and they were better able to better evaluate the program (66.7% RPS vs 6.3% RUS) in the RPS format.

Conclusions: When compared to traditional RUS during an MS4 rotation, a RPS format provided students with the perception of an improved learning experience, ability to showcase knowledge, and familiarity with the residency program without sacrificing teaching from attending physicians. [West J Emerg Med. 2021;22(1)15-19.]

INTRODUCTION

Integrating medical students into a busy emergency department (ED) is often challenging.¹ While the ED offers hands-on learning experiences for students, some of these opportunities may be lost due to the pace of the ED and clinical demands of the providers. Student exposure to emergency medicine (EM) is limited in the preclinical years, and a clinical rotation provides an opportunity for students to explore a potential career in EM.^{2,3} For students who have decided or may decide to apply for residency

training in EM, these clinical rotations in the fourth year of medical school, commonly known as "audition" rotations, are available at the majority of EM residency programs. These rotations give applicants the opportunity to compare and contrast different EM residency programs, obtain a Standard Letter of Evaluation (SLOE), and to "audition" for a spot in the residency program by highlighting their individual characteristics.⁴

One obstacle to medical students' educational and potential "audition" experience in EDs is the frequent changes

in supervising emergency physicians due to shift scheduling. Students typically work with multiple resident and attending physicians, but might not work with the same physician more than once. While this allows medical students to interact with more emergency physicians, this lack of continuity may provide little opportunity for medical students to highlight personal growth and implementation of feedback. These difficulties can be compounded in busier EDs such as ours with 68 residents and over 135,000 visits annually. It is also unclear to what degree this lack of continuity with supervising physicians affects on-shift teaching, learning content, and overall impressions of residency programs.

Medical student clinical rotations in the ED are traditionally formatted such that students are assigned shifts in the department irrespective of the schedules of supervising physicians, either resident or attending. To increase continuity between students and supervising physicians, some programs have begun to match students' schedules with those of specific resident physicians.⁵ Bernard et al found that a small cohort of students rated frequency and quality of feedback, interactions, and teaching superior with their "continuity-based shift model," similar to our RPS format.⁵ Historically, our program has employed an unpaired scheduling format. In the current study we sought to compare a traditional, unpaired medical student/resident schedule with a paired schedule. Specifically, we compared medical student perceptions of the two schedule formats in regard to learning experience, "audition" opportunity, and familiarity gained with the residency program.

METHODS

This was a prospective crossover trial at an Accreditation Council for Graduate Medical Education (ACGME)-accredited postgraduate year (EM, PGY1-4) residency program from May–August, 2019. The purpose was to evaluate two different rotation schedule designs for fourth-year medical students (MS4). The hospital system does not have an affiliated medical school, and MS4s from multiple medical schools rotate in the ED. We chose this time frame because it represents a common time period in which MS4s applying to EM residency programs for the following year (2020) would complete their "audition" rotations.²

MS4s rotating in EM over four consecutive four-week blocks were assigned two weeks using a traditional block schedule with resident-unpaired shifts (RUS) and two weeks with resident-paired shifts (RPS). For two of the four blocks, the MS4s rotated first using the RUS schedule for two weeks followed by the RPS schedule for two weeks. For the other two blocks, this order was reversed in order to diminish the potential bias based on the order of the two schedule types.

The RUS schedule involved MS4s choosing a predesigned block schedule with changing shift times and locations within the ED without continuity in terms of working with particular residents or attending physicians.

Population Health Research Capsule

What do we already know about this issue?
By increasing continuity between teacher-learner during medical student EM rotations, there is an increase in the amount and quality of feedback a learner receives.

What was the research question?
Do resident paired shifts improve a student's educational experience, familiarity with the program and audition opportunity?

What was the major finding of the study?
A student's experience, familiarity with the program and ability to showcase knowledge improve with resident paired shifts.

How does this improve population health?
Resident paired shifts in an EM clerkship improves a student's perception of their educational experience and ability to learn about a potential residency program.

The RPS schedule assigned an MS4 with a resident physician in the PGY-3 or PGY-4 year so that they worked the same schedule as the resident physician. The number of shifts worked by each MS4 in both the RUS (seven shifts) and RPS schedules (six shifts) were similar although not evenly matched to allow for all students to have an equal number of total shifts and limitations in department capacity. All shifts in both the RPS and RUS schedule were eight hours in length and under the supervision of an attending physician. To minimize potential bias, all PGY-3 and PGY-4 residents working in the ED during this time period participated in the study if their schedule met the minimum number of required shifts. Resident physicians were advised of the schedule change for students but were given no further instruction.

At the conclusion of the four-week block an anonymous, confidential, and voluntary electronic survey instrument was sent to all participating MS4s. The instrument used closed-ended, ranked Likert-scale responses to evaluate the student learning experience, "audition" opportunity, familiarity with the residency program, and overall preference for schedule type (Appendix A). These domains were specifically chosen due to their importance to both prospective applicants and residency programs. The survey was reviewed by educational faculty with expertise in medical student education and residency recruitment. It was then edited for clarity and relevance to the aforementioned domains of interest based

on feedback provided. Additionally, the MS4s were given the opportunity to provide general comments and feedback via a free-response field.

We analyzed the data using SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY). For each item, responses were trichotomized and a one-sample two-tailed chi-square analysis tested the null hypothesis of equal preference for the RPS schedule and RUS schedule at a significance level of 0.05. For the purposes of the analyses, responses indicating “more” or “much more” preference for either the RPS or RUS were counted as a single category and compared. In addition to quantitatively analyzing which schedule format respondents preferred, the authors reviewed the free response section for positive and negative comments regarding the two schedule formats and their impact on the aforementioned domains. The study was exempted by the institutional review board.

RESULTS

Of 57 MS4s 48 completed the survey, representing an 84% response rate. Students indicated more direct teaching time (64.6% RPS vs 8.3% RUS; $P < 0.001$) and teaching that was more appropriate for their level of training (50% RPS vs 6.3% RUS; $P < 0.001$) with the RPS format, while the amount of teaching time students received directly from the supervising attending physicians was similar in the two groups (14.6% RPS vs 18.8% RUS; $P = 0.617$). In addition, respondents indicated that the resident paired shifts made students more comfortable asking clinical questions (72.9% RPS vs 2.1% RUS; $P < 0.001$) and resulted in the perception of a better overall educational experience (68.8% RPS vs 8.3% RUS; $P < 0.001$) (Table 1).

In items evaluating the respondents “audition” opportunity, students indicated that they were better able to showcase their medical knowledge (52.1% RPS vs 6.3%

RUS; $P < 0.001$) and that the program got to know them better as applicants in resident-paired shifts (66.7% RPS vs 10.4% RUS; $P < 0.001$) (Table 2). For familiarity with the residency program, the resident-paired shifts led to more opportunities to ask questions about the residency program (56.2% RPS vs 4.2% RUS; $P < 0.001$), and students indicated they were better able to evaluate the program in this format (66.7% RPS vs 6.3% RUS; $P < 0.001$) (Table 3).

A free-response section allowed students to comment on their experience with the two formats and which they preferred and why. Of the 43 responses to this section, 25 students stated that they preferred the resident format (58.1%), while three stated they preferred the block format (7.0%). Although not presented as an option, 13 respondents (30.2%) stated that they preferred a mix of both formats, especially if they were able to work with a resident for two weeks prior to starting a traditional unpaired block format. Specific comments regarding the advantage of the RPS format included the following: “nice having a familiar face while learning about how the emergency department at Stroger worked”; “gave me the opportunity to ask about the general workflow/ thought process in the ED”; and “I really enjoyed being paired up with a resident, but may have appreciated it even more during the first 2 weeks instead of the last 2 weeks.”

Three themes emerged from the free-response section regarding the RPS format: 1) the format allowed for an increased ability to showcase their knowledge; 2) it gave the students the opportunity to demonstrate a progression of their skills over time; and 3) provided them increased familiarity with the residency program. Many respondents indicated that the RPS provided a balance of mentorship/ guidance from the resident while still being able to interact with an attending, as represented by the following comment: “I really liked working with one resident because I felt like I was able to still see patients autonomously with an attending

Table 1. Medical student learning experience comparing resident-paired vs unpaired schedules.

	More or much more with RPS (%)	No difference (%)	More or much more with RUS (%)
Which schedule format allowed you to receive more direct teaching time?*	31/48 (64.6%)	13/48 (27.08%)	4/48 (8.3%)
Which schedule format allowed you to receive teaching that was more appropriate for your level of training?*	24/48 (50.0%)	21/48 (43.75%)	3/48 (6.3%)
Which schedule format allowed for more direct teaching time from attending physicians?	7/48 (14.6%)	32/48 (66.67%)	9/48 (18.8%)
In which schedule format were you more comfortable asking questions about patient care and medical knowledge?*	35/48 (72.9%)	12/48 (25%)	1/48 (2.1%)
Which schedule format allowed you to maximize your educational experience during the rotation?*	33/48 (68.8%)	11/48 (22.92%)	4/48 (8.3%)

RPS, resident-paired schedule; RUS, resident-unpaired schedule; * = $P < 0.001$.

Table 2. Audition opportunity.

	More or much more with RPS (%)	No difference (%)	More or much more with RUS (%)
Which schedule format do you feel allowed the program to get to know you better as an applicant?*	32/48 (66.7%)	11/48 (22.92%)	5/48 (10.4%)
Which schedule format allowed you to demonstrate your knowledge of emergency medicine better?*	25/48 (52.1%)	20/48 (41.67%)	3/48 (6.3%)

RPS, resident-paired schedule; RUS, resident-unpaired schedule; *= $P < 0.001$.

but I had one person I knew really well who I could talk to and get advice from.” The few comments favoring the RUS format discussed a more extensive exposure to various teaching styles and viewpoints along with more attending interaction, represented by the following comment: “The block schedule in the beginning exposed me to more residents in the program which gave me a better idea of how I’d fit in, and allowed me to hear from multiple people about their experiences”; “I felt that I missed out on certain learning opportunities towards the second half if someone who was not my assigned senior had a cool case/procedure.”

DISCUSSION

In this prospective crossover trial, we demonstrate the positive impact of a MS4 schedule format that increased continuity between learner and teacher in the following ways: learning experience; “audition” opportunity; and familiarity with the residency program. The results suggest that a two-week period of RPS fostered a more satisfactory educational experience for the students and “audition” opportunity, as well as perceived familiarity with the residency program.

As the SLOE has become one of the most valued parts of a MS4’s application to prospective residency programs, it is important that a student’s performance is adequately and accurately assessed during an EM rotation.^{2,6} This can be difficult given the nature of student scheduling in the ED as a student might work with different faculty and residents each shift, making it hard to demonstrate longitudinal improvement, form relationships, and show the ability to incorporate feedback. Our study demonstrates that two-thirds of rotating students believed the residency program was better able to assess their abilities as a potential applicant and half believed they could better demonstrate their EM knowledge with a resident-paired schedule. However, this study did not examine the residency program’s ability to better evaluate the applicant with either format. The RPS led to 67% of students gaining a better understanding of the residency program, thereby further fulfilling one of the primary objectives of doing an “audition” clinical rotation.² Overall, using the RPS appears to help satisfy the goals of an “audition” rotation better than the RUS.

An essential part of any medical student rotation is to

ensure there is appropriate educational content delivered to the student.^{3,7} While this can happen in the form of scheduled didactic conferences and independent studying, much of this learning is done during clinical shifts in EM. Compared to the standard RUS, when paired with a resident for part of their rotation the majority of students felt more comfortable asking questions, had more direct teaching appropriate for their level of training, and overall had a better educational experience. By using a RPS schedule, clerkship directors and residency leadership can improve rotating medical students’ satisfaction with their educational experience. Interestingly, direct teaching time from attending physicians was reported by two-thirds of students to be similar with the resident-paired and resident-unpaired schedules. This suggests that despite the perception of an overall increase in direct teaching time with the resident-paired schedule, it was not at the expense of direct teaching from the supervising attending physicians.

While the survey required that students state a preference for either the RPS or the RUS format, the free-response section of the survey allowed for about a third of the respondents to observe that they would favor a combined schedule format, having both the RPS and RUS for two weeks. Originally, having students experience both formats was done for each student to serve as their own control between the two schedule formats, but these responses suggest that the combination of schedules may provide some advantages. From the free responses, it became clear that students preferred having the RPS during the initial portion of a rotation to become better acclimated with a new hospital environment and operations of the ED. Some responses indicated having a familiar resident to whom they could direct questions helped with this process, at least initially. In the second half of the rotation, an unpaired schedule may have helped to expose the students to varying practice and teaching styles. Therefore, a combined schedule format with RPS in the first two weeks and RUS during the last two weeks may be the ideal combination, allowing for the learner to benefit from the advantages of each format and should be further investigated.

LIMITATIONS

One limitation of this study was the individualized experience each student had with their paired resident as there

Table 3. Familiarity with residency program.

	More or much more with RPS (%)	No difference (%)	More or much more with RUS (%)
Which schedule format gave you more opportunities to ask questions about the residency program?*	27/48 (56.2%)	19/48 (39.58%)	2/48 (4.2%)
Which schedule format gave you a better ability to learn about and evaluate the residency program?*	32/48 (66.7%)	13/48 (27.08%)	3/48 (6.3%)

RPS, resident-paired schedule; RUS, resident-unpaired schedule; *= $P < 0.001$.

were at times a disproportionate number of PGY-4 vs PGY-3 residents paired with students, given monthly scheduling limitations. If a certain resident was more adept at teaching on shift or there was a personality mismatch between the student and resident this could have altered the perception and educational experience of the RPS. This study did not examine how these interactions impacted the objective performance or perceptions of the student. Although medical students are aware of being evaluated during all their medical school rotations, there was still the possibility of the Hawthorne effect given that students were made aware of the two formats and the eventual comparison survey during their rotation orientation. While it was mentioned that the resident pairing was new compared to the traditional unpaired shifts and could have led to favoring of this new format, no indication was made as to which format was favored by the clerkship leadership during the orientation.

Another limitation was the subjectivity of each individual's experience, especially if they were planning on EM as a future career. This could have altered their perception of the quality of the education during the rotation. As this study was conducted at a single institution, the results may not be generalizable to other institutions and should be repeated at other program types and settings to ensure comparable results. Finally, limitations that are inherent in survey studies are likely present in our results. These include interpretation of survey answer choices; lack of memory of the experience while completing the survey the weeks following the rotation's end; and, the possibility that respondents could have been concerned about commenting negatively about the residency program even though the surveys were anonymous with no answer data identifying a particular student.

CONCLUSION

We found that medical students perceived a better educational experience and "audition" opportunity, as well as the opportunity to learn more about the residency program with a two-week resident-paired schedule when compared to a traditional resident-unpaired schedule. This type of scheduling should be studied in other settings and program types to ensure comparable results. Medical student clerkship directors might consider including a resident-paired schedule portion

in their rotation schedule to improve the students' satisfaction with their educational experience and provide the preferred format for the student to evaluate the residency program.

Address for Correspondence: Sean Dyer, MD, Cook County Health and Hospital Systems, Department of Emergency Medicine, 1950 W Polk, Professional Building, 7th Floor, Chicago, IL 60613. Email: sdyer2@cookcountyhhs.org.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Comparison of Standardized Letters of Evaluation for Emergency Medicine Residency Applicants

David Wilson*

*Thomas Jefferson University, Sidney Kimmel Medical College, Philadelphia, Pennsylvania

Chaiya Laoteppitaks, MD†

†Thomas Jefferson University, Department of Emergency Medicine, Philadelphia, Pennsylvania

Shruti Chandra, MD†

Section Editor: Jonathan Fisher, MD, MPH

Submission history: Submitted July 15, 2020; Revision received December 13, 2020; Accepted December 14, 2020

Electronically published December 21, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.49086

Introduction: Medical students pursuing an emergency medicine (EM) residency are advised to obtain at least two Standardized Letters of Evaluation (SLOE). Students often complete one rotation at their home institution and at least one “away” rotation at a program separate from their home institution. The SLOE was introduced as an objective evaluation tool. The aim of this study was to determine whether there was a difference in scores between home rotation and away rotation SLOEs.

Methods: We retrospectively reviewed the SLOEs of all applicants to an urban, academic EM residency program. For each SLOE, we calculated a composite score from rankings in seven “Qualifications for EM” (CS7), and converted comparative rank score (CRS) and estimated rank list position (ERP) to percentile scores. The CS7, CRS, and ERP on the home rotation SLOE were compared to those of the away SLOE using a paired t-test.

Results: An evaluation of 721 applicants with at least one home SLOE and one away SLOE demonstrated a significant increase in the ERP of home rotators ($P = 0.003$). The data did not demonstrate a statistically significant difference in the CS7 ($P = 0.69$), or CRS ($P = 0.97$).

Conclusion: Our study demonstrated that the only difference in SLOEs is that students are likely to be given a slightly higher estimated placement on the rank order list on a home SLOE. We hope this will help residency leadership with reviewing applications. [West J Emerg Med. 2021;22(1)20-25.]

INTRODUCTION

Medical students interested in pursuing an emergency medicine (EM) residency are advised to obtain at least two Standardized Letters of Evaluation (SLOE) from their rotations in EM.^{1,2} The SLOE is a letter template set forth by the Council of Emergency Medicine Residency Directors that was implemented to more effectively compare EM applicants.^{3,4} In order to obtain two SLOEs students often complete one rotation in EM at their home institution and one away rotation at a program other than their home institution.¹ Most program directors (PD) cite SLOEs as an important factor in inviting applicants to interview for a residency position, demonstrating the importance of the SLOE to aspiring emergency physicians.^{1,5,6} The SLOE gives readers objective data by ranking students in tertiles in seven

categories of “Qualifications for EM.” Additionally students are ranked as the top 10%, top third, middle third, or bottom third for a global assessment and estimated position on the rank list.⁷

Many aspects of the SLOE have been studied. Li et al evaluated gender biases in SLOEs and found that the narrative portions were, “relatively free of gender bias.”⁸ A study from Pelletier-Bui et al surveyed SLOE writers and found that most SLOE writers did not strictly adhere to the SLOE guidelines citing a fear that a weak evaluation could prevent an applicant from obtaining a position as an EM resident.⁷ Girzadas et al studied the precursor to the SLOE, the standardized letter of recommendation, and found that female letter writers were twice as likely to give the highest ranking to female applicants giving a basis for some ingroup bias.⁹ Although the effect

of home institution on a SLOE was not studied until 2019,¹⁰ Program directors have long held slight preference for a SLOE from an away rotation over a SLOE from their home rotation.⁶ In 2019, Boysen-Osborn et al found that among applicants to a single, urban, academic EM residency program there was a significant difference between home and away institution SLOE scores.¹⁰ This confirmed for many the suspicion that students receive more favorable scores on SLOEs from their home rotation.

In this study we aimed to determine whether there was a significant difference between the objective data in SLOEs obtained from home rotations and SLOEs obtained on away rotations. We sought to determine whether any change in student performance was limited to a single category in the SLOE and to quantify the difference, if one existed.

METHODS

We performed a single-center retrospective review of all US senior applications to the Thomas Jefferson University Hospital EM residency program through the Electronic Residency Application Service in the 2018-2019 application cycle. This study was given Thomas Jefferson University Hospital institutional board review approval before the study began.

A data abstractor collected the following for each applicant: self-identified gender; home institution; United States Medical Licensing Examination (USMLE) Step 1 score, USMLE Step 2 clinical knowledge score, whether the home rotation was first, and SLOE data. For each SLOE, we collected the location of the rotation, whether the author was an individual or committee, the scores for each question in part B "Qualifications for EM," and the rankings in part C "Global Assessment." The senior investigator met periodically with the abstractor to resolve any questions. Data were stored in an online secure database, OneDrive (Microsoft Corp., Redmond, WA).

We screened all SLOEs from traditional four-week EM rotations, and recorded data for all SLOEs from US senior applicants. We excluded applicants who did not have at least one home and one away rotation SLOE. In cases where a student received two SLOEs from the same rotation, only the SLOEs authored by a faculty committee, PD, or clerkship director (CD) were considered. We considered a home program to be an EM training program that was the primary affiliate of the student's medical school or one that was available to all students from the school and did not require an application to be accepted.

The primary outcome of this study was the effect of home institution on SLOE rankings. This was done by comparing three data points for each applicant's home and away SLOEs: a composite score of the seven "Qualifications for EM" from SLOE part B (CS7); the comparative rank score from SLOE part C1 (CRS); and estimated rank list placement from SLOE part C2 (ERP). The CS7 has a score range of 7-21 with 7 being the most favorable and 21 the least favorable. CRS and

Educational Research Capsule Summary

What do we already know about this issue?

The away rotation Standardized Letters of Evaluation (SLOE) is often favored over the home rotation SLOE by Program Directors when reviewing applications to residency programs.

What was the research question?

This study sought to determine if there is a difference in the objective data between home and away SLOEs.

What was the major finding of the study?

The data showed that there is no difference in ratings in two major rankings between the SLOEs.

How does this improve medical education?

This study should offer residency programs more clarity when evaluating applicant SLOEs.

ERP are rated as top 10%, top third, middle third, or bottom third. To calculate the magnitude of any difference between home and away SLOE scores, we converted these percentiles to 10, 33, 67, and 100, respectively, rather than using ordinal numbers. The lowest percentiles are most favorable, ie, top 10% is better than top 67%. For students with more than one home or one away SLOE, a mean was calculated for each ranking, and the mean was used in the comparison. We compared scores for each outcome on the home rotation SLOE to the respective score from the away rotation SLOE using a paired t-test.

RESULTS

In the 2018-2019 application cycle, there were 1823 US senior applicants to EM.¹¹ The EM residency at Thomas Jefferson University Hospital received 1078 applications from US seniors. Of the received applications, 721 fit our inclusion criteria, and we recorded data for these applicants who had SLOE data from at least one home and one away rotation (Figure 1).

Our primary outcomes were the composite score of the CS7, the CRS, and the ERP. From our cohort of 721 applicants we found no significant difference between the CS7 from the home SLOE and away SLOE ($P = 0.69$). We found no significant difference between the CRS from the home SLOE and away SLOE ($P = 0.97$). We found an average of 6.9% increase in ERP (95% confidence interval, 2.4-11.5) on a home SLOE compared to an away SLOE ($P = 0.003$). For each outcome, we graphically represent the distribution

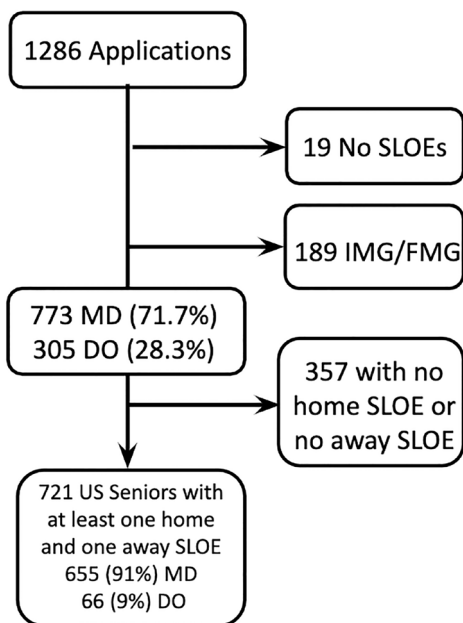


Figure 1. Inclusion and exclusion of study subjects. SLOE, Standardized Letter of Evaluation; IMG, international medical graduate; FMG, foreign medical graduate; MD, doctor of allopathic medicine; DO, doctor of osteopathic medicine.

of the change in scores (Figure 2-4). Further analysis looked at the same outcomes controlling for self-identified gender, degree type, and whether the home rotation was the first one completed (Table 1).

Applicants self-identifying as male gender had an average increase in ERP of 8.5% on the home SLOE, which was statistically significant (95% CI, 1.7-15.2), whereas female-identifying applicants had an average increase in ERP of 4.4% on the home SLOE, which was not statistically significant (95% CI, -0.33-9.1). With a small sample size ($n = 66$), osteopathic students had a small but statistically significant benefit across all three outcomes of this study. Similarly, with a small sample size ($n = 83$), students who completed an away rotation first had improved scores on the home rotation SLOE that were statistically significant across all three outcomes.

We conducted a secondary analysis among the cohort of applicants ($n = 100$) that received more than one SLOE from a single rotation including a SLOE from a committee or the institution's standard letter writer and individual faculty. Individual faculty SLOE data differed significantly from the data from the standard letter writers and committees. The CS7 score, on average, was 1.6 points better on the SLOE from individual faculty (95% CI, 1.0,2.1). The CRS was 18.6% more favorable on the SLOE from individual faculty (95% CI, 14.2,23). The ERP was 16.5% improved from the SLOE from individual faculty (95% CI, 11.4,21.6) Each of these differences were significant with $P < .005$. Across all three outcomes, the SLOE written by the individual faculty member (as opposed to a committee letter) was statistically significantly more favorable.

DISCUSSION

These findings are consistent with, and further build upon, the results from Boysen-Osborn et al, while reinforcing the integrity and objectivity of the SLOE. In the 2019 study, a combined score of the CRS and ERP was used as the outcome to conclude that home SLOEs were more favorable for students than away SLOEs.¹⁰ These findings isolate the difference in SLOEs to the ERP. Using converted percentiles rather than ordinal numbers allows for more clarity in defining the magnitude of the difference between the SLOEs. It is reassuring that there was no significant difference in CS7 or CRS as this reinforces that students are not favored by home SLOEs. However, this finding seems to be contradicted by the better ERP scores from home SLOEs. Because the difference is seen only in the ERP, it is reasonable to say that programs rank students from their institution higher than equal students from other institutions. This could be because the program already knows the applicant or has had more interaction with this student. This student may also be more likely to stay at their home institution. Additionally, given that the difference between the SLOEs is only in one rating, it is less likely that SLOEs are affected by implicit preference for home rotating students. A true preference would yield a difference across all outcomes.

The data reports a statistically significant increase in ERP from a home rotation SLOE of almost 7% (95% CI, 2.4-11). However since the SLOE stratifies by top 10%, top third, middle third, and bottom third, the 7% increase may not have placed the student in a different tier. While this could result in a different ERP score for some students, the difference may not be apparent for others. This finding shows that the objective scores on SLOEs do not vary significantly between home and away rotations. In the situation where only one home SLOE is available in the student application, especially given that the current landscape of the COVID-19 pandemic has severely limited the ability to complete away rotations, programs may regard home SLOEs as more reliable than in the past.

While the average applicant saw a modest increase in ERP from their home rotation SLOE, it appears that the bulk of this advantage fell to male-identifying students. It should be made clear that this means male-identifying students are more likely to see an increase in ERP from a home rotation SLOE, whereas female-identifying students are unlikely to see any difference in ERP between home and away SLOEs. While this study did not aim to determine whether or not a gender bias exists in the SLOEs' objective data, this could be an area worth exploring. Despite Li et al finding that narrative portions of the SLOE are relatively free of gender bias, our findings, in addition to evidence of a gender gap in EM resident evaluations discovered by Dayal et al and a recent report showing that EM trainees are 65% male, are enough to investigate the effect of gender on the objective portions of the SLOE.^{8,9,12,13}

Although potentially limited by a small sample size ($n =$

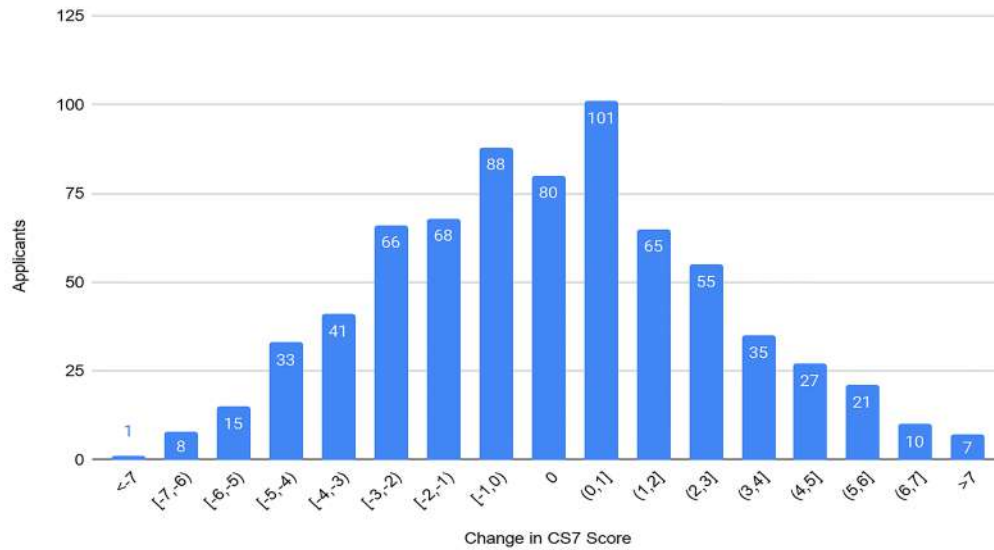


Figure 2. Distribution of CS7 score changes between home and away SLOEs. A negative change in score represents a more favorable score on the home rotation SLOE. CS7, composite score of the seven “Qualifications for Emergency Medicine.”

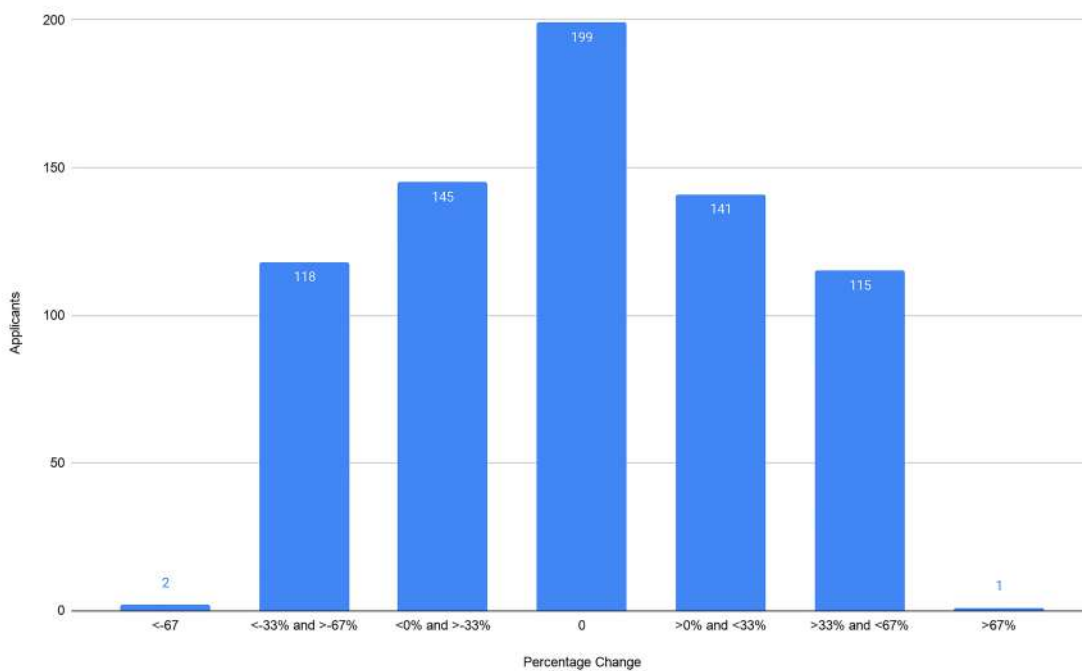


Figure 3. Distribution of percentile changes in comparative rank scores between home and away Standardized Letters of Evaluation (SLOE). A negative change in score represents a more favorable percentile ranking on the home rotation SLOE. CRS, comparative rank score.

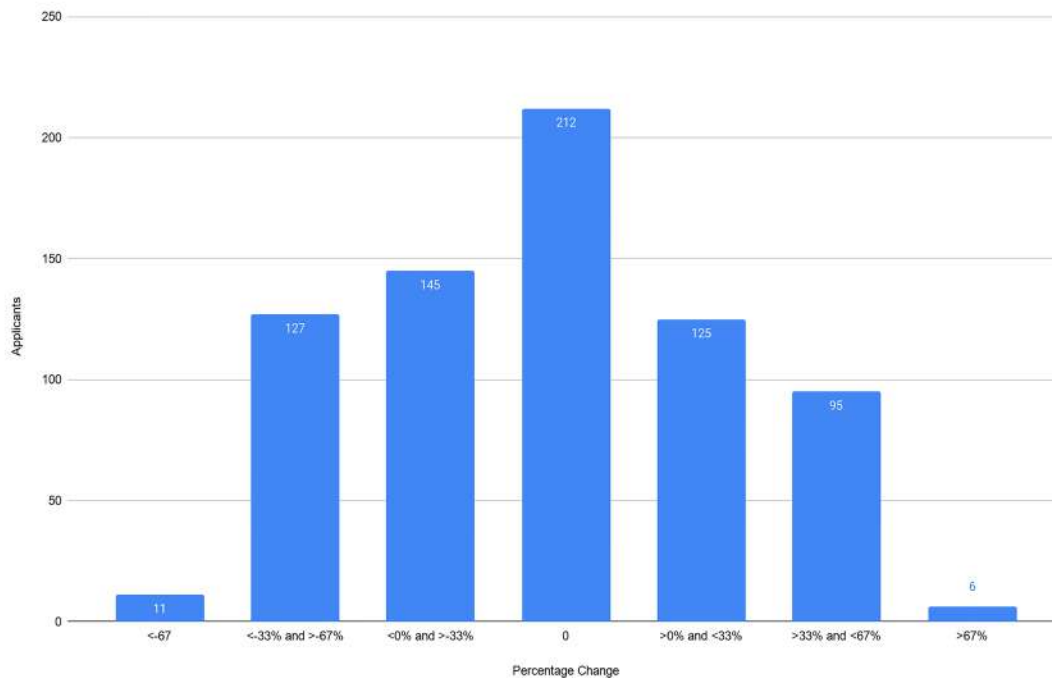


Figure 4. Distribution of percentile changes between estimated rank list placement between home and away rotations. A negative change in score represents a more favorable percentile ranking on the home rotation Standardized Letter of Evaluation. ERP, estimated rank list placement.

66), osteopathic students saw a larger benefit than allopathic students in ERP from a home rotation. Osteopathic students also had statistically significant improvement in CS7 and CRS from a home rotation. While most osteopathic institutions do not have an affiliated home EM rotation, there may be a significant advantage to osteopathic students with a home rotation SLOE. Similarly, limited by sample size ($n = 83$), students who completed away rotations first saw a larger improvement in home SLOE scores than the rest of the cohort. This could be explained by increased comfort in the ED and prior experience of the students who were completing a home rotation as a second or third EM rotation.

Our secondary analysis showed that SLOEs written by individual faculty members who were not standard SLOE writers varied significantly from SLOEs written by standard SLOE writers for the same applicant during the same rotation. Committee SLOEs are already recognized as superior to individual SLOEs. Individual SLOEs are treated as classic narrative letters of recommendation; our data simply supports this.

The SLOE has evolved over the years and remains an integral part of the EM residency application. Many PDs continue to use USMLE Step 1 scores as part of the residency selection process because of its utility for predicting future board certification.^{1,6,14} Given that Step 1 score-reporting will soon become pass/fail, it would be helpful to correlate SLOEs

with future board certification, and perhaps it is time for the SLOE to undergo a new evolution to become predictive in such a manner.

LIMITATIONS

Our study had several limitations. Although our sample did account for almost 60% of all US seniors applying into EM, we only reviewed the SLOEs of applicants to a single institution, which could have skewed the data. We used a definition for a home rotation that may not be uniform among all residency programs reviewing applications. While some institutions have obvious relationships with EM residency programs, some are more covert. Our study did not take into account whether the letter was written by an individual or SLOE committee, and did not consider the geographic location of away rotations.

CONCLUSION

This study explores the difference between home rotation and away rotation SLOEs. In this study we concluded that the only difference in SLOEs was that students were likely to be given a slightly higher estimated placement on the rank order list on a home SLOE. Further topics of study could consider geographic location of the away rotations and their proximity or relationship to the home institution or consider the first SLOE vs the second SLOE in addition to home vs away letters.

Table 1. Primary outcomes comparing home and away Standardized Letters of Evaluation. A negative difference translates to a more favorable score from the home rotation. Outcomes also stratified by degree type, self-identified gender, and whether the home rotation was the first rotation completed.

	n (%)	Average USMLE Step 1 Score	Average USMLE Step 2 CK Score	Change in CS7 (95% CI)	Change in CRS (95% CI)	Change in ERP (95% CI)
Total	721	229	245	0.04 (-0.18,0.27)	-0.04% (-2.1,2.0)	-6.9%* (-11.5,-2.4)
MD	655 (90.8)	229	245	0.16 (-0.07,0.39)	1.0% (-1.2,3.2)	-5.8%* (-10.6,-1.1)
DO	66 (9.2)	228	240	-1.1* (-1.9,-0.3)	-10.3%* (-16.5,-4.1)	-17.7%* (-33.6,-1.78)
Male	449 (63.1)	231	244	0.13 (-0.15,0.43)	0.23% (-2.4,2.9)	-8.5%* (-15.2,-1.7)
Female	272 (37.7)	227	246	-0.11 (-0.47,0.25)	-0.48% (-3.8,2.8)	-4.4% (-9.1,0.33)
Home First	638 (88.5)	229	245	0.17 (-0.08,0.41)	1.1% (-1.14,3.32)	-5.4%* (-10.1,-0.62)
Away First	83 (11.5)	227	242	-0.88* (-1.45,-0.30)	-8.7%* (-13.8,-3.7)	-19.0%* (-34.3,-3.63)

* $P < .05$

USMLE, United States Medical Licensing Examination; CK, clinical knowledge, CI, confidence interval; CS7, composite score of the seven "Qualifications for EM"; CRS, comparative rank score; ERP, estimated rank list placement; MD, doctor of allopathic medicine; DO, doctor of osteopathic medicine.

Address for Correspondence: David Wilson, MD, Thomas Jefferson University Sidney Kimmel Medical College, 1651 Thompson Building, 1020 Sansom St., Philadelphia, PA 19107. Email: david.wilson@students.jefferson.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Residents' Perceptions of Effective Features of Educational Podcasts

Jeffrey C. Riddell, MD*
Lynne Robins, PhD†
Jonathan Sherbino, MD‡
Alisha Brown, MD§
Jonathan Ilgen, MD, MCR¶

*Keck School of Medicine, University of Southern California, Department of Emergency Medicine, Los Angeles, California
†University of Washington, Department of Biomedical Informatics and Medical Education, Seattle, Washington
‡McMaster University, Department of Medicine, Hamilton, Ontario
§Virginia Mason Hospital and Medical Center, Department of Emergency Medicine, Seattle, Washington
¶University of Washington, Department of Emergency Medicine, Seattle, Washington

Section Editor: Danielle Hart, MD

Submission history: Submitted July 15, 2020; Accepted October 15, 2020

Electronically published December 10, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.49135

Introduction: Educational podcasts are used by emergency medicine (EM) trainees to supplement clinical learning and to foster a sense of connection to broader physician communities. Yet residents report difficulties remembering what they learned from listening, and the features of podcasts that residents find most effective for learning remain poorly understood. Therefore, we sought to explore residents' perceptions of the design features of educational podcasts that they felt most effectively promoted learning.

Methods: We used a qualitative approach to explore EM trainees' experiences with educational podcasts, focusing on design features that they found beneficial to their learning. We conducted 16 semi-structured interviews with residents from three institutions from March 2016–August 2017. Interview transcripts were analyzed line-by-line using constant comparison and organized into focused codes, conceptual categories, and then key themes.

Results: The five canons of classical rhetoric provided a framework for thematically grouping the disparate features of podcasts that residents reported enhanced their learning. Specifically, they reported valuing the following: 1) Invention: clinically relevant material presented from multiple perspectives with explicit learning points; 2) Arrangement: efficient communication; 3) Style: narrative incorporating humor and storytelling; 4) Memory: repetition of key content; and 5) Delivery: short episodes with good production quality.

Conclusion: This exploratory study describes features that residents perceived as effective for learning from educational podcasts and provides foundational guidance for ongoing research into the most effective ways to structure medical education podcasts. [West J Emerg Med. 2021;22(1)26-32.]

INTRODUCTION

Podcasts are accessible and engaging learning tools, offering broad exposure to core content and personalized learning while simultaneously fostering a sense of connection to local and national professional communities.¹ In fact, emergency medicine (EM) trainees report using educational podcasts more frequently than textbooks or journals.²⁻⁴ Yet despite their appeal, most clinicians do not listen to podcasts in a manner that aligns with evidence-based best practices

for learning.⁵ Some clinicians report listening to podcasts while engaged in other activities (eg, driving, exercising), where they may struggle to maintain the attention needed to comprehend the content.^{1,5,6} Others report that they stop listening to educational podcasts if they don't feel "engaged."⁷ Given these realities of podcast use, podcast producers have been encouraged to more intentionally structure podcasts in ways that keep learners interested and engaged as they fit podcast listening into their busy lives.¹

Past work has suggested that some instructional design features of podcasts might stimulate more learning than others,^{1,5,7} although how these can be implemented in practice remains poorly defined.^{8,9} Drawing from existing educational theories, several features have been recommended, including interpolating questions,¹⁰ repetition of key points,¹ short segments,¹¹ interview style,¹² narrative stories,¹³ casual tone,⁹ and written show notes.⁹ Missing from past recommendations, however, is a deeper exploration of the relationship between what the technology affords and how listeners interact with it.^{14,15} Exploring residents' perceptions of their listening experiences could garner insight into how podcasts can be more intentionally designed to align with the ways that they actually incorporate them into their daily lives.¹⁶ Thus, the purpose of this study was to explore and describe residents' perceptions of the features of educational podcasts that they feel most effectively promote learning.

METHODS

This was a secondary analysis of a subset of data collected for a larger study that explored how residents use podcasts for educational purposes.¹ We conducted this secondary thematic analysis of our transcripts to provide a richer and more nuanced description of the podcast features that residents reported enhanced their learning. Thematic analysis offers a flexible research approach to both examine different participant perspectives and make sense of their rich and complex narratives in ways that are illuminating and stay true to the data.¹⁷ Recognizing that our backgrounds and assumptions influence our analysis,¹⁸ we intentionally built our research team to include two physicians with significant experience recording, producing, and listening to medical podcasts (JR, JS), two physicians with some experience listening to medical podcasts (AB, JI), and one collaborator with background training in anthropology and extensive experience with qualitative research methods in health professions education (LR). One of the physicians (JR) also has a background in speech communication and rhetoric.

Setting, Population, and Sampling Strategy

Expecting that trainees' podcast listening experiences might be impacted by their backgrounds, clinical experiences, and training contexts, we purposively sampled a heterogeneous cohort of EM residents, including different postgraduate years, genders, and institutions. Participants were recruited from one Canadian institution (McMaster University) and two American institutions (University of Washington and University of California, San Francisco). The research and ethics boards at all three institutions approved the study. We invited trainees to participate by targeted emails. All participants provided verbal informed consent at the beginning of the interview and received a \$25 gift card after completing the interview.

Procedure

The principal investigator (JR) conducted hour-long, one-on-one, semi-structured interviews with participants in person or via video conference from March 2016–August 2017. We developed the interview guide based on previous surveys and the personal experiences of our research team.²⁻⁴ We asked open-ended questions that encouraged participants to describe their listening experiences with educational podcasts, and then used probing questions to explore the particular design features that impacted their perceived learning during these experiences. Although we adapted the interview guide iteratively as the study proceeded,¹⁹ we made no significant changes to the questions about preferred features of podcasts (eAppendix A). Audio recordings from each interview were de-identified, transcribed, and uploaded to Dedoose (SocioCultural Research Consultants, LLC, Los Angeles, CA) for data analysis.

Analysis

Our analysis was informed by sensitizing concepts²⁰ drawn from classical rhetoric.²¹⁻²³ Dating back to the ancient philosophers Aristotle and Cicero, classical rhetoric provides a framework for understanding the creation of persuasive communication.²¹ The five canons of classical rhetoric (invention, arrangement, style, memory, delivery) represent an organizing taxonomy of communication processes that have recently been adapted to help understand new media through the field of digital rhetoric.^{24,25}

We analyzed participants' narratives iteratively alongside data collection. Using a constant comparative process, four authors (JR, AB, JI, LR) coded transcripts line-by-line to organize the data into focused codes and key conceptual categories.¹⁸ The entire team discussed the meaning of – and connections between – these codes in light of our research questions. Codes were sorted into themes, which were further reviewed, named, and defined in discussion with the entire research team.¹⁷ We employed memoing, triangulation of data among researchers, and an audit trail of the analytical process to enhance the trustworthiness of our analysis.^{26,27} One author (JR) then coded the final six transcripts. Finding no additional insights or counterexamples, we deemed our sample theoretically sufficient to address our study purpose.²⁸

RESULTS

Sixteen EM residents (5 female, 11 male) representing postgraduate years (PGY) 1 through 4/5 participated in this study, and all had past experience listening to EM podcasts. The demographics of these participants are listed in Table 1.

Participants consistently identified several themes of podcast features that impacted their perceptions of learning. We found the five canons of classical rhetoric (invention, arrangement, style, memory, delivery) to be particularly well aligned with these themes and have thus presented our data below within this organizational framework.

Table 1. Characteristics of participants (n = 16).

Postgraduate year (PGY)	
PGY-1	2 (13%)
PGY-2	7 (44%)
PGY-3	4 (25%)
PGY-4/5	3 (19%)
Institution	
McMaster University	5 (31%)
University of California, San Francisco	5 (31%)
University of Washington	6 (38%)
Gender	
Female	5 (31%)
Male	11 (69%)

Invention

The process of discovering and refining the best argument for a specific audience constitutes the rhetorical canon of invention. In our context, participants voiced a preference for podcasts that were closely aligned with their clinical experiences. In emphasizing the importance of this *clinical relevance*, they eschewed podcasts that were “too technical” or “over my head” (4, PGY-2), opting instead for content that was directly relevant to their day-to-day practice. As one senior resident elaborated:

“It has to be clinically relevant. So there are some podcasts out there that I think get very potentially bogged down in some of the minutia. For me that’s not why I listen to podcasts.... So, it’s something that is talking about how to manage a patient, and it’s not going deep into necessarily the pathophysiology, or the pharmacology, unless it’s really relevant to the discussion...” (10, PGY-4)

Residents also expressed a preference for podcast segments in which learning points were distilled and clearly signposted. More junior residents especially valued podcasters who summarized information into what they perceived to be “spoon fed” or “high yield” (5, PGY-2) take-away points. Highlighting the importance of this *emphasis on key points*, one resident explained:

“I think those things are important for learners like me that can sometimes get lost in the details and then it’s nice to at the beginning and end be told like, ‘Oh, this is what’s important about this. Here is all the details, but remember this is what’s important about this.’” (1, PGY-1)

Additionally, residents felt that podcasts that featured *multiple voices* were effective in highlighting expert

clinicians’ nuanced variations in diagnosis, management approaches, or treatments. In contrast to “...someone just lecturing you” (1, PGY-1), residents elaborated on the effectiveness of conversations between hosts that “...allow people to touch on different thoughts or different nuances...” (1, PGY-1) of clinical situations. One resident explained:

“With these you get numerous different perspectives as very few of these actually have one narrator, so you’re getting different viewpoints... you’re getting guest speakers, you get specialists in certain areas... That’s a big thing.” (7, PGY-2)

Arrangement

Arrangement represents the process of organizing arguments for maximum impact. Our participants generally valued podcasts that provided information with *efficiency*, and expressed a preference for podcast segments to make their points directly without feeling like they have to “listen forever to try to figure out what you are trying to tell me” because they were “...not going to have the patience for that.” (12, PGY-3) One participant noted:

“An effective podcast doesn’t waste a lot of time with filler space, they focus on the key information and they distill down noise about the topic into what’s most... relevant and useful when taking care of patients... they focus. They’re to the point.” (2, PGY-2)

Style

The process of determining how an argument is presented represents the canon of style. Residents emphasized that *how* material was presented in a podcast had substantial impact on their learning. They described how humor and sound effects helped to keep them “engaged” (3, PGY-3) and “retain the information better” (3, PGY-3). Residents perceived that they were able to maintain their attention in ways that were different than traditional textbook or didactic learning, as elaborated by one participant:

“...sometimes the acting, the interludes with jokes and music and humor; it stimulates things and keeps things interesting. And it doesn’t become just a boring lecture, it becomes an entertaining means of learning” (7, PGY-2).

Multiple residents described a preference for podcasts that were conversational and included personalized accounts of clinical cases. *Storytelling* enhanced residents’ perceived engagement with podcast content, especially when experienced emergency physicians described particularly challenging or illustrative clinical experiences. One resident noted:

“Maybe they are sharing a story tied in with the information that they need you to understand. So, it

kind of ties you in emotionally as well... You can hear in their voice and then you put yourself in their shoes and I think having that ability to try and visualize the experience and go through it as well is beneficial learning" (2, PGY-2).

Memory

The canon of memory, while traditionally related to the process of memorizing a speech, also invites consideration of creating structures that make messages easy to remember. In the context of podcasts, residents overwhelmingly valued podcasts designed with repetitive segments that emphasized key points multiple times. Recapping helped to "hit it home" (5, PGY-2), cementing take-away points that may have been missed the first (or second) time. A second-year resident elaborated:

"Yeah, so I love how on [X podcast] they just kind of repeat and repeat and repeat. They summarize and then they summarize their summary... then they say it 5 minutes later again and that repetition is good." (5, PGY-2)

Delivery

Delivery represents the act of conveying material to an audience. Drawing comparisons to popular non-medical audio content such as National Public Radio,²⁹ residents valued podcasts that attended to *technical qualities* that led to pleasant listening experiences. One resident explained, "I also have [to have] good enough production quality to make it listenable" (12, PGY-3), while others reported they would stop listening if the audio quality was "bad enough that I can't hear what people are saying." (12, PGY-3)

Podcast *length* also seemed to impact their perceptions of whether a listening experience was effective, and residents expressed a preference toward shorter podcasts as a means to maintain focus. Longer episodes were described as "...just too much... too much noise for me to try to filter out and I don't have time for that..." (2, PGY-2) They did not want to listen "...to the same topic for an hour" (1, PGY-1), preferring instead content that was "...bite sized, in that you can take a topic and do it in 15 minutes." (11, PGY-2)

DISCUSSION

These data suggest that EM residents deliberately attend to identifiable podcast features when deciding whether their listening experiences are likely to promote effective learning. Participants in this study expressed a preference for short, well-produced podcasts in which they heard multiple perspectives on clinically relevant subjects. They gravitated toward podcasts that humanized medicine through storytelling and humor while at the same time optimizing their perceived learning through efficiency and repetition of explicit learning points.

Podcasts are an oral and audible form of communication akin to the ancient Greek and Roman speeches around which

the five canons of classical rhetoric were developed.³⁰ As such, these well-established canons can provide important insights into communication and learning from educational podcasts.³¹ Whether intentionally or accidentally, podcasters appear to draw heavily on ideas from ancient rhetoricians to create educational experiences that are distinct from traditional materials (such as written texts).³² One example is the stylistic use of music and sound effects in podcasts, which participants reported helped them stay engaged while listening. The ability to animate core medical content with analogies, anecdotes, jingles, and jokes offers new ways of making a learning experience memorable. Whether this engagement leads to more effective learning remains uncertain, as past work suggests that "cues that arise when monitoring learning and performance are often not highly predictive of actual learning and performance."³³ Regardless, the value residents place on podcast-based learning requires careful attention to what the technology affords and how listeners interact with it.³⁴

Regarding memory, it is heartening to see some alignment between residents' judgments of learning and existing literature around effective instructional techniques. Our participants' endorsement of repetition is encouraging and aligns with the value of repetition for learning that was described over 135 years ago.^{35,36} Past work, however, would suggest that optimal spacing of repetition occurs over the course of several days, not necessarily over the several minutes of a podcast segment.³⁷ And while some evidence supports the value of more condensed repetition timelines,³⁸ future work might explore the effect of repetition on long-term knowledge gain within a focused podcast segment.

Our themes that fit within the canons of invention, memory, and delivery seem to interact when viewed through the lens of cognitive load theory. It stands to reason that short segments that are repeated and summarized may be more likely to be remembered. Working memory can only process a limited amount of information at any given time, creating a "bottleneck" for learning.³⁹ When the cognitive load associated with a task exceeds the learner's working memory capacity, learning is impaired.^{39,40} The "distilled down" nature of podcasts may help decrease extraneous – or redundant – information; shorter segments may require less information to be held in working memory; and repetition of key information can allow content that was missed due to overloaded working memory to be revisited at a time when the listener may no longer be overloaded.⁴¹

Likewise, our participants' preference for high-quality sound may also reflect an important feature that minimizes extraneous load during the learning process. There are notes of caution to be sounded, however, about the cognitive load of podcast listeners. The varied contexts in which residents listen – often while exercising or driving⁵ – may carry with them extraneous loads that decrease learning capacity.⁴² While residents have some insight into their distracted listening,¹ further studies that explore how the rhetorical features of

podcasts effect learning during simultaneous task performance may help guide effective listening behaviors.

While stories have long been an effective medium for ordering and storing complex human and clinical experiences,⁴³ we were surprised to hear the degree to which residents emphasized the importance of storytelling and a diversity of perspectives. Storytelling is a tool that can depict real-world clinical care, providing depth, context, and nuance around what colleagues *actually do* in practice.⁴⁴ Listening to engaging stories of how expert clinicians navigate challenging cases and conflicts may have an emotional bearing on the audience, causing them to develop strong affective responses of empathy and identification.⁴⁵ In addition to fostering a sense of connection to local colleagues and national communities, our resident participants also emphasized the correlation between feeling connected to their storytellers and the learning they gleaned from listening to their stories.¹

While this paper departs from existing rhetorical analysis of popular podcasts such as *Serial*⁴⁶ and *Revisionist History*³⁰ by examining listeners' experiences with a broader genre, thinking about medical education podcasts as rhetorical objects can deepen our understanding and facilitate our investigation of the role of language in medical training.⁴⁷ We can begin to extend our attention beyond the mere ordering of medical facts outlined in a podcast to consider the social values and goals represented by, and reflected in, the platform.⁴⁸ Moving beyond traditional instructional design features, we can consider the ways stories stimulate the imagination, drawing listeners in and keeping their attention so that they remain ready for learning.⁴⁵ This move emphasizes what language does, not just what it says,⁴⁸ and transfers our attention from what is said (content) to what is accomplished (action).⁴⁷ This rhetorical frame might help explain why podcasts remain such a popular learning resource for trainees; like ancient Roman orators, podcasters – by accident or intention – appear to be effective rhetors, using storytelling, multiple voices, repetition, humor, and sound effects as persuasive means of affecting perceptions of learning.

LIMITATIONS

Our study carries several limitations. Our purposive sampling of EM residents in the Western United States and Canada may not represent the preferences of trainees in other disciplines or geographies. The greater representation of males compared to females in our study, while not far from the gender representation of EM trainees on the whole, may limit transferability across learners.⁴⁹ Further, we did not define “effectiveness” for our interviewees, opting instead to allow them to determine how they *perceived* effectiveness. Our representations of residents' perceptions of effectiveness must be contextualized within the literature on the limitations of self-assessment and judgments of learning.⁵⁰⁻⁵² These findings should serve as a guide to future realist evaluations that examines these features to determine what works, where, and why,⁵³ rather than be viewed as a definitive prescription for podcast optimization.

CONCLUSION

Emergency medicine residents deliberately attend to the rhetorical features of podcasts to decide whether their listening experiences are likely to promote effective learning. Residents feel they learn from short, well-produced podcasts in which they hear multiple perspectives on a clinically relevant subject. They gravitate toward podcasts that humanize medicine through storytelling and humor, while at the same time optimizing their perceived learning through efficiency and repetition of explicit learning points. The five canons of classical rhetoric may provide a useful framework to understand the rhetorical nature of podcasts and their influence on perceptions of learning.

ACKNOWLEDGMENTS

We would like to thank Joshua Jauregui, MD, and Michelle Lin, MD, for their feedback on early aspects of this project. We would also like to thank Dr. Ron Pyle for his early contribution to our understanding of the history and theory of rhetoric.

Address for Correspondence: Jeffrey C. Riddell, MD, Keck School of Medicine, Department of Emergency Medicine, 1200 N State St., Los Angeles, CA 90033. Email: jriddell@usc.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Resident Self-Assessment and the Deficiency of Individualized Learning Plans in Our Residencies

David Della-Giustina, MD*
Ali Kamran, MD*
D. Brian Wood, MD†
Katja Goldflam, MD*

*Yale School of Medicine, Department of Emergency Medicine, New Haven, Connecticut
†St. Joseph's Medical Center, Department of Emergency Medicine, Stockton, California

Section Editor: Danielle Hart, MD, MACM

Submission history: Submitted June 7, 2020; Revision received October 19, 2020; Accepted October 24, 2020

Electronically published December 11, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48615

Introduction: The focus of residency training is to ensure that graduates attain a minimum level of skills and knowledge in order to be able to practice independently. While there are multiple formal methods to evaluate a resident, there is a paucity of literature that describes whether programs have residents perform individual self-assessment (ISA) with the development of individualized learning plans (ILP) to better themselves. We sought to investigate the current state of emergency medicine (EM) residency programs using ISA and determine whether these assessments are used to develop an ILP for each resident.

Methods: An electronic survey was developed by educators at our institution and sent to all program leaders of United States EM residencies approved by the Accreditation Council for Graduate Medical Education. An individualized email request was sent to non-responders. Results were obtained from February–May 2019.

Results: Of 240 programs we contacted, 119 (49.5%) completed the survey. Seventy-nine percent of programs reported that they had all residents perform an ISA. These were completed semiannually in 69% of the programs surveyed, annually in 19%, less than annually in 8%, and quarterly or more frequently in 4%. Of those programs requiring a resident ISA, only 21% required that all residents develop an ILP; 79% had only those residents requiring additional help or no residents develop an ILP.

Conclusion: Most programs that completed the survey reported having residents complete an individual self-assessment, but there was variation in the areas assessed. The majority of programs had only lower performing, or no residents, develop an ILP based on this. [West J Emerg Med. 2021;22(1)33-36.]

INTRODUCTION

In 2013, the Accreditation Council for Graduate Medical Education (ACGME) released the Emergency Medicine (EM) milestones to help delineate the progress of a resident in attaining skills in each competency domain and enhancing their assessment and feedback for improvement.¹ These milestones have become the standard for guiding resident assessment and have been used to identify individual resident improvement areas. One area that has not been standardized

is a resident individual self-assessment (ISA) process. This is important, as one of the ACGME Common Program Requirements is practice-based learning and improvement, which includes constant self-evaluation and lifelong learning.²

Self-assessment, combined with faculty feedback, is an essential step toward improving resident performance.^{3,4} In EM education, other than a single oral board scenario,³ there is no description in the literature regarding the use of resident self-assessment paired with the development of an

individualized learning plan (ILP) to promote continued resident self-improvement. In this study, we sought to investigate the current state of EM residency programs' use of ISA and to determine further whether these assessments were used to develop an ILP for each resident.

METHODS

A literature review was conducted by a clinical support librarian using both keywords and controlled vocabulary combining the terms for education, medical, graduate, high achiever, high performing, highly competent, rock star, intern, resident, residency, and house staff. The search was executed on January 2, 2019. The literature review encompassed seven decades from 1946 to December 31, 2018, and included the following databases: OVID Medline; OVID Embase; PubMed; the Web of Science Core Collection; Scopus; and CINAHL. A total of 1795 records with 1025 original articles were found. Based on the review of this information, we created a homegrown, 11-question survey as we were unable to find a previous survey that explored our questions. This novel survey was refined through discussion and editing by multiple EM educators at our institution to help ensure utility and comprehension. This study was approved as exempt by the institutional review board at Yale University.

The anonymous survey was sent to all ACGME-accredited EM residency leaders through the Council of Residency Directors in Emergency Medicine (CORD-EM) listserv as an anonymous link using an online survey platform (Qualtrics LLC, Provo, UT). Responses were collected from February–May 2019. An individual follow-up email was sent to the program directors who did not respond to the original request. The first question in the survey asked for the program name to ensure that no duplicate programs were included in the data analysis. At the time of the study, there were 240 ACGME-approved residency programs. Respondent characteristics and responses to survey questions are presented as counts and percentages.

RESULTS

Of 240 programs surveyed, 119 (49.5%) completed the survey. Forty-three (36%) programs had a residency complement size of 18-30, 35 (29%) had between 31-40 residents, and 41 (34%) had more than 40 residents. Regarding resident completion of an ISA, 118 responded and 94 (79.7%) reported that they required all residents to complete an ISA, 14 (11.9%) did not require any resident to perform an ISA, and 10 (8.5%) required only those residents who needed additional help to complete an ISA. Of those programs requiring an ISA, 99 responded regarding the frequency and assessment areas for the resident ISA. The frequency of ISA completion was semiannual for 68 (69%) programs, annual for 19 (19%), less than annual for 8 (8%), and quarterly or more frequently for 4 (4%).

The percent of programs that had residents self-assess in the following categories were as follows: 90 programs required an academic ISA (90%); clinical 83 (84%);

leadership 49 (50%); and other 28 (28%), with the most common free text being wellness-related in 15 (15%) programs. Academically, the 90 programs had residents self-assess in the following categories: medical knowledge 73 (81%); research 40 (44%); knowledge dissemination 32 (36%) (presentations, articles, etc); and other 13 (14%). Clinically, the 83 programs had residents self-assess in the following categories: efficiency 70 (84%); teamwork 59 (71%); management of specific medical conditions 43 (52%); presentations 35 (42%); and other 19 (22%). In leadership, the 49 programs had residents self-assess in the following categories: team leadership 35 (71%); residency leadership 33 (67%); organizational leadership 24 (49%); and other 6 (12%).

Regarding the outcome of resident ISA, Figure 1 depicts how many programs required residents to develop an ILP.

DISCUSSION

This survey is an initial appraisal regarding EM residency programs' use of an ISA and subsequent development of an ILP. A majority of programs had residents perform an ISA on at least a semiannual basis. As would be expected, the areas of assessment focus for most programs were academic and clinical, with further subclassification into knowledge, efficiency, and team leadership. There was considerable variation in the other areas of assessment. Encouraging ISA and self-directed learning was an objective in developing the milestones in the ACGME Next Accreditation System.⁵ When performed in isolation, however, self-assessment has been found to be ineffective and inaccurate and could be considered potentially dangerous.^{6,7} To guide residents in developing a meaningful ISA, feedback should be used to help direct that assessment.^{6,8}

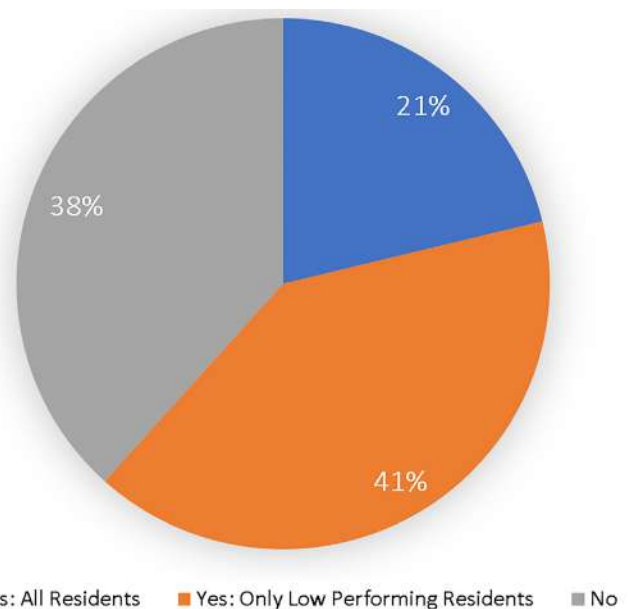


Figure 1. Percentage of emergency medicine residency programs requiring an individual learning plan.

In our survey, we did not inquire whether the resident ISA was used in isolation or paired with formal feedback. This is an important question, as it has been suggested that there is a poor relationship between physician self-ratings of performance and the ratings provided by external raters.⁹ Further, this inaccuracy may be worse for the least competent physicians, who overestimate their competence.^{10,11} A study involving EM residents demonstrated that they consistently rated themselves as better than their attendings' assessments of them in every sub-competency assessed.¹² This understanding of the need to pair feedback from multiple sources with an ISA should be considered in developing a standardized ISA in the future.⁸

Another finding is that only 21% of residencies have all of their residents develop an ILP. This may be interpreted that the high and even average performing residents, as defined by those programs, may be less challenged to continue their growth and development of expertise, which should be the focus of residency training. Regardless of their expertise, each resident has some area where they could further their knowledge or skills. This would be the benefit of each resident developing an ILP.

In helping residents develop an ILP, Wolf et al., suggest that this occurs with both internal and external sources of feedback regarding the resident performance under the guidance of a trusted mentor.^{8,13} This mentor can help guide the resident to an appropriate plan, as informed self-assessment is a flexible, dynamic process of accessing, interpreting, and responding to varied internal and external data. Alone, an informed self-assessment is characterized by multiple tensions that arise from complex interactions among competing internal and external data, multiple influencing conditions, and emotional responses to the information.^{8,13} The mentor can help guide the interpretation and responses to the feedback, focusing on a cogent ILP.^{8,14} This mentor should be engaged in the learner's learning and improvement, aware of standards to include knowledge of curricula and level-specific standards, and skilled in facilitating and providing feedback.¹⁴ Guided self-assessment and self-directed learning through the development of an ILP do not mean that learners should be left on their own. Rather, they require structuring and scaffolding of learning experiences, guidance, and feedback.¹⁴

One consideration in the discussion on the use of ISA and the subsequent development of ILPs is the descriptive term preceding self-assessment. Sargeant uses the term "informed" self-assessment, whereas Wolff uses the term "guided" self-assessment.^{8,13,14} The term "guided self-assessment" is the more inclusive term that should be used when describing the process of a learner performing an informed self-assessment and then developing an ILP using a mentor.

LIMITATIONS

The major limitation of this study was the response rate of just below 50%. The survey did not specify who was to take it, nor did it request the respondent's name, so we

cannot verify that a residency leader completed it. Another limitation was that we did not define several of the terms such as "lower performing resident," "individual self-assessment," and "formal individualized learning plan." While this was intentional to allow each program leader to determine what they felt fit these terms, it may have confused the final results, as what one program leader considers a self-assessment may not count for another program leader. Additionally, because there is no standard definition for "lower-performing," this lack of clarity may have led program directors to underestimate or overestimate the percentage of residents required to develop an ILP.

CONCLUSION

Most EM programs require residents to complete some form of individual self-assessment, but there is no current standard regarding the frequency and areas assessed. Further, only a minority of programs use the ISA as a catalyst for the development of formal individualized learning plans for all of their residents. These are both areas that are open for further standardization and exploration as tools in residency education.

Address for Correspondence: David Della-Giustina, MD, Yale School of Medicine, Department of Emergency Medicine, 464 Congress Ave, Suite 260, New Haven, CT 06519. Email: David.della-giustina@yale.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Standardized Patient Experience: Elevating Interns to Expected Level of Clinical Competency

Megan Cifuni, MD
Caroline Stoddard, MD
Scott Witt, MD
Cameron Pfennig-Bass, MD
Mark Pittman, MD

Prisma Health Upstate, Department of Emergency Medicine, Greenville, South Carolina

Section Editor: Jonathan Fisher, MD, MPH

Submission history: Submitted July 14, 2020; Revision received October 19, 2020; Accepted October 16, 2020

Electronically published November 20, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.49092

Introduction: Medical students transition to intern year with significant variability in prior clinical experience depending on their medical school education. This leads to notable differences in the interns' ability to perform focused histories and physical exams, develop reasoned differentials, and maximize care plans. Providing a foundational experience for these essential skills will help to establish standardized expectations despite variable medical school experiences.

Methods: During an orientation block, interns participated in a standardized patient experience. Interns were presented with three common chief complaints: abdominal pain; chest pain; and headache. Faculty observed the three patient encounters and provided immediate verbal and written feedback to the interns based on a standardized grading rubric.

Results: All residents that participated "agreed" or "strongly agreed" that the experience was a meaningful educational experience. 90% of the interns reported the experience would change their clinical practice. Additionally, 75% of residents surveyed one year after the experience felt the experience changed their clinical practice. Faculty felt the learning experience allowed them to address knowledge gaps early and provide early guidance where needed.

Conclusion: This article describes an emergency medicine residency program's effort to provide a foundational experience for interns in evaluating emergency department patients. The intent was to "level the playing field" and establish "good habits" early in intern year with the realization that prior experiences vary significantly in July of intern year. [West J Emerg Med. 2021;22(1)37-40.]

BACKGROUND

Since the 2008 development of the Emergency Medicine Milestones Project, residency programs have focused on using these competency-based benchmarks to assess resident progression through training. The stepwise progression of the Milestones acknowledges that medical training is certainly a continuum of learning.^{1,2} We have found that new emergency medicine (EM) interns fall at variable points on this spectrum of medical knowledge and skill. However, it is the assumption of the Accreditation Council for Graduate Medical Education that graduating medical students, and thus new interns, function at a Milestone Level 1.^{3,4} It is our experience that diverse

medical school experiences lead to some interns beginning EM residency not yet able to achieve this Level 1 competency.

Determining which interns require more directed guidance and focused education can be difficult in a busy clinical environment. Direct observation is often cited as a tool to assess clinical competency.⁵ However, we find that direct observation can be difficult and is often underused in hectic emergency department (ED) environments. We propose a uniform assessment of incoming EM interns in a mock standardized patient scenario with the purpose of gauging gaps in clinical competencies. This allows for more directed education and focused correction of potential knowledge gaps.

OBJECTIVES

The objective of creating a standardized patient experience for incoming EM interns is multifold. Our first goal was to simulate realistic EM patient encounters focusing on common ED chief complaints. Our second goal was to observe the EM interns interacting with a standardized patient and determine potential correctable behaviors during history taking and physical examination. The final goal was to evaluate the interns' ability to synthesize the patient presentation, provide a reasoned differential and plan, and communicate effectively with the patient.

CURRICULAR DESIGN

We created a simulated patient encounter for three common ED chief complaints: chest pain; abdominal pain; and headache. Standardized patients were briefed and prepared on their cases prior to the encounters. To begin the encounters, interns were informed of the patient's age and gender, chief complaint, and vital signs. Interns entered an exam room and were given 10 minutes to perform a focused history and physical exam.

During this time, the interns were observed by a faculty member (assistant program director or medical education fellow). The interns were then given 15 minutes to collect their thoughts and present the patient to the faculty member. Through this presentation, they were expected to develop and communicate a reasoned differential and plan of care for the patient. The interns were then assessed using a rubric created to identify potential gaps in their knowledge base and skill set.

We were able to assess several of the Level 1 Milestones for patient care (PC) during this activity:

- Performs and communicates a reliable, comprehensive history and physical exam (PC2)
- Determines the necessity of diagnostic studies (PC3)
- Constructs a list of potential diagnoses based on chief complaint and assessment (PC4)
- Describes basic resources available for care of the emergency department patient (PC7).

Based on the above milestones and our judgment of essential EM intern skills in patient assessment, we created an assessment rubric (Figures 1 and 2).

STANDARDIZED PATIENT OBSERVATION & PRESENTATION EVALUATION			
Resident Name:	Case:		
Faculty Evaluator:	Date:		
	Above Expectation	Meets Expectation	Needs Improvement
History			
Asks an open-ended question to obtain chief complaint			
History of Present Illness (Obtains at least 6 factors)			
- Provoking/palliating factors	- Quality	- Onset	
- Associated Symptoms	- Radiation	- Timing	
	- Severity	- Location	
Past Medical History (Obtains all 4)			
- Medical	- Surgical	- Meds	- Allergies
Social History (Obtains all 3)			
- Obtains appropriate Family History			
- Asks about tobacco use			
- Asks about illicit and alcohol use			
Review of Systems (Obtains 2 factors in 10 systems)			
- Constitutional	- Cardiac	- Skin	
- Head, Ear, Nose, Throat	- Gastroenterology	- Allergy	
- Eyes	- Endocrine	- Neurology	
- Respiratory	- Genitourinary	- Psych	
	- Musculoskeletal		
Physical Exam			
Maintains privacy during physical exam			
Examines under gown/blanket as appropriate i.e. not listening to heart sounds through gown, or DP pulses through socks			
Exam			
Always obtains at least cardiopulmonary and abdominal exam			
Obtains history directed physical exam			
Communication			
Knocked on Door, performed hand hygiene, greeted SP			
Resident was empathetic and caring			
Appropriate eye contact and nonverbal cues during encounter			
Avoids Medical Jargon			
Rarely interrupts patient			
Management			
Discusses care plan and next steps with the patient			
Asks patient if they have an questions on care plan			
Makes informed diagnostic and treatment decisions based on differential			
Oral Patient Presentation			
Presents HPI, ROS, PMH and PE in an organized manner			
Presents assessment statement			
Appropriate differential with at least 5 "can't miss" diagnoses			

Figure 1. Page one of the standardized patient rubric to assess interns' skills in patient assessment.

The first year we implemented this activity, interns completed a documentation chart after their interaction with the patient as opposed to presenting the patient orally to the observing faculty member. However, we found that review of the written documentation was very labor intensive and time-consuming and therefore delayed assessment by the faculty member, prohibiting immediate, timely feedback. The oral presentations allow for the faculty member to directly provide verbal and then written feedback to the interns without delay. For other programs considering implementation but worried about cost, we used a total of six standardized patients at \$20 per hour for a total of five hours. The observation certainly could use additional faculty or residents to play the part of standardized patients for a similar effect.

IMPACT/EFFECTIVENESS

The implementation of this standardized patient experience during orientation month has been well received by our residents. Immediately following the activity, 100% of interns surveyed “agreed” or “strongly agreed” that it was a meaningful

and educational experience; 90% of those interns also reported that the encounter would change their clinical practice starting intern year. These findings have persisted over time as 90% of our second-year residents, who were surveyed one year after the experience, also agreed that the activity was meaningful and educational, and 75% felt that the experience had changed their clinical practice.

This standardized patient encounter allows educational faculty to address any knowledge gaps or re-direct any poor habits early in intern year. We have found that although direct clinical observation is commonly cited as a tool for assessing residents, it is often cumbersome on shift and therefore done hastily or infrequently. Creating a standardized patient experience outside of the clinical arena allows for more careful observation and meaningful feedback. These initial assessments can then be compared to on-shift direct observations completed by faculty to determine intern progression. This innovation could certainly be adopted by other EM programs or even by other specialties as a benchmark assessment and intervention to help “level the playing field” at the start of intern year.

Global Assessment of Core Competencies

Patient Care: compassionate, appropriate, and effective for the treatment of health problems and the promotion of health				
Needs Improvement	2	Meets Expectations	4	Above Expectation
1		3		5
Comments:				
Medical Knowledge: formulates an appropriate differential diagnosis with attention to life-threatening conditions, demonstrate the ability to utilize medical resources effectively, and apply this knowledge to clinical decision making.				
Needs Improvement	2	Meets Expectations	4	Above Expectation
1		3		5
Comments:				
Interpersonal and Communication Skills: effective information exchange and teaming with patients, their families, and other health professionals.				
Needs Improvement	2	Meets Expectations	4	Above Expectation
1		3		5
Comments:				
Professionalism: commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population				
Needs Improvement	2	Meets Expectations	4	Above Expectation
1		3		5
Comments:				
Systems-Based Practice: demonstrates an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value				
Needs Improvement	2	Meets Expectations	4	Above Expectation
1		3		5
Comments:				

Circle best description of overall clinical competence for this patient encounter:

Needs Improvement Meets Expectations Above Expectations

Summary Comments:

Recommendations for Clinical Environment:

Figure 2. Page two of the standardized patient rubric.

Address for Correspondence: Caroline Stoddard, MD, Prisma Health Upstate, Department of Emergency Medicine, 701 Grove Road, Greenville, SC 29605. Email: caroline.stoddard2@prismahealth.org.

Conflicts of Interest: By the *WestJEM* article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Addressing Racism in Medicine Through a Resident-Led Health Equity Retreat

Anita N. Chary, MD, PhD*

Melanie F. Molina, MD*

Farah Z. Dadabhoy, MD, MSc*

Emily C. Manchanda, MD, MPH†

*Harvard Affiliated Emergency Medicine Residency, Boston, Massachusetts

†Boston Medical Center, Department of Emergency Medicine, Boston, Massachusetts

Section Editors: Chris Merritt, MD, MPH, MHPE

Submission history: Submitted June 14, 2020; Revision received September 3, 2020; Accepted October 19, 2020

Electronically published November 20, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48697

Racism impacts patient care and clinical training in emergency medicine (EM), but dedicated racism training is not required in graduate medical education. We designed an innovative health equity retreat to teach EM residents about forms of racism and skills for responding to racial inequities in clinical environments. The three-hour retreat occurred during the residency didactic conference to maximize resident participation. We prioritized facilitated reflection on residents' own experiences of race and racism in medicine in order to emphasize these concepts' relevance to all participants. We used workshop, small group, and panel formats to optimize interactivity and discussion. Post-retreat survey respondents indicated that the curriculum successfully promoted awareness of racism in the workplace. Participants also expressed interest in continued discussions about racism in medicine as well as desire for greater faculty and nursing participation in the curriculum. Residency programs should consider incorporating similar educational sessions in core didactic curricula. [West J Emerg Med. 2021;22(1)41-44.]

BACKGROUND

Racism refers to prejudice or discrimination directed against an individual or group on the basis of race.¹ Patient care and healthcare providers' experiences of the workplace are affected by racism.² Resident physicians encounter racial discrimination directed toward patients and providers throughout clinical training.³⁻⁵ Discrimination may be amplified in the acute care environment of emergency medicine (EM). Implicit bias, or learned stereotypes that operate unconsciously and automatically, can be exacerbated in times of stress, when working with limited information, and in time-pressured situations—factors often present in emergency care.⁶

While some curricula exist to teach EM residents about social determinants of health and implicit bias,⁷⁻⁹ dedicated didactic teaching about racism in medicine is not required in EM residency curricula or in graduate medical education more broadly. We describe an innovative health equity retreat designed to teach residents about racism and its manifestations in medicine.

OBJECTIVES

The educational objectives of the retreat were the following: 1) to raise awareness of race-based inequities in patient and resident experience; and 2) to build residents' skills in recognizing and addressing racial inequities and microaggressions. To maximize opportunities for resident participation, the retreat was held during mandatory residency didactic conference, during which junior residents were protected from clinical duties. The retreat aimed to encourage peer discussions about racism and the potential roles of clinicians, bystanders, and allies in promoting equitable patient care and an inclusive training environment.

CURRICULAR DESIGN

Four senior residents leading the residency's Social Emergency Medicine group designed the retreat after conducting a literature review of existing EM curricula on race⁷⁻⁹ and holding working group meetings. A deliberate decision was made to base the retreat on the facilitated reflection of our own residents' experiences of race, racism,

and disparities in their specific clinical practice environments in order to emphasize these concepts' relevance to all participants. Educators developed the curriculum around three major learning objectives: 1) understand definitions and examples of different forms of racism in emergency medicine; 2) understand the definitions and impacts of microaggressions; and 3) understand how provider bias impacts patient care. Retreat leaders assessed participant achievement of these objectives through a post-event survey.

Prior to the retreat, residents were invited to anonymously submit written accounts of how race and racism have affected them, their colleagues, and their patients in the emergency department (ED), through an online form. Eighteen of 58 residents submitted experiences, which were used as the basis for delivering the content of the retreat. At the time of the retreat, the racial composition of residents in the program was 63% White, 9% Black, 7% Latinx, and 21% Asian. The residency is based in an urban area of the Northeast United States, with residents reporting origins from the Northeast (42%), Southeast (2%), Southwest (8%), West (17%), Midwest (15%), Puerto Rico (2%), and foreign countries (10%).

The health equity retreat was comprised of three one-hour sessions held with 56 participants (40 of 58 residents, 16 faculty members). Eighteen residents were not present at the retreat, due in part to vacation periods and senior residents' clinical obligations. The first session was an interactive

presentation about forms of racism, led by a resident with a professional background in anthropology and race theory. Audience members, selected at random, were given envelopes containing quotations drawn from experiences submitted by their co-residents. The lecturer then called on these audience members to stand up and read the quotes aloud. The lecturer subsequently unpacked each quote to explain how the quote embodied key concepts about race. Quotes and paraphrased examples are included in Table 1, with permission from submitting residents.

The second session was a workshop devoted to microaggressions, defined as brief, commonplace words or actions (intentional or unintentional) that communicate hostility to or insult members of marginalized groups.¹⁰ Following a 15-minute didactic presentation, pairs of senior residents led small group discussions with residents and faculty members. Individual residents within each pair held different racial and gender identities. Discussion included the distinction between the intent and the impact of microaggressions. Specific cases were reviewed in which individuals' intentions were benign, e.g., telling a resident, "You're so well-spoken!" or confusing one resident of color for another. Small groups discussed the implications of these statements—in these examples, that people of a certain race are not expected to be well-spoken, or that residents of color are seen as interchangeable—and explored their negative

Table 1. Key concepts of racism illustrated through resident experiences.

Concept	Definition	Example
Interpersonal racism	Expression of racism between individuals, such as harassment, racial slurs, racial jokes, or singling someone out on basis of race	A patient tells the resident, "I don't want a Black doctor."
Institutional racism	Discriminatory treatment, unfair policies and practices, and inequitable opportunities within organizations or institutions based on race	Patients of color with congestive heart failure are disproportionately admitted to medicine, rather than cardiology. ¹³
Internalized racism	Viewing oneself or one's group through dominant prejudices about the inferiority of people of color	A resident reported preference to introduce self by first name, as "I was afraid that [my patients] would find out I am Hispanic and feel that they were being shortchanged, or even refuse my care."
Stereotype	A standardized mental picture held in common about members of a group, representing an oversimplified opinion or judgment, without regard to individual difference	A clinician comments that a Latinx patient presents with 'total body dolor' and is in 'status hispanicus.'
Implicit Bias	Learned stereotypes and prejudices that operate automatically, and unconsciously, when interacting with others, regardless of one's intentions	An attending physician comments that a Black patient with sickle cell disease is "drug-seeking" and discourages the resident from ordering opioids.
Microaggression	Brief, commonplace words or actions, intentional or unintentional, that communicate hostility to or insult members of marginalized groups	"50% of my patient encounters include the patient/patient's family questioning where I went to college and medical school."
Privilege	Advantages and immunities enjoyed by one usually powerful group or class, to the disadvantage of others	"Every time I walk into the room with a female attending and the patient only makes eye contact with me [a white male resident]."

Definitions are adapted from the Boston Public Health Commission/Core Workshop.¹²

impact on clinicians, particularly when occurring as a repeated experience. Strategies for responding to microaggressions were also reviewed, which have been published elsewhere.⁵

The third session reviewed the impact of patient race on the management of agitated patients in the ED. Example cases compared and contrasted management of White and Black patients with similar levels of agitation, including differential application of restraints and involvement of hospital security. A panel of EM attendings, social workers, and psychiatrists were invited to provide commentary. Resident facilitators then reviewed an algorithm they created to promote unbiased de-escalation of agitated patients in the ED (Appendix A). In cases where an immediate threat to physical safety is absent, the algorithm encourages clinicians to perform a brief internal assessment about whether race could be contributing to perceptions of threat, and provides specific strategies to facilitate verbal de-escalation.

IMPACT/EFFECTIVENESS

An anonymous survey evaluating the retreat was sent to the 56 participants. Closed-ended questions assessed perceived utility of the sessions in teaching key concepts about race, microaggressions, and bias, using a five-point Likert scale (1=not at all useful, 2=slightly useful, 3=moderately useful, 4=very useful, 5=extremely useful), as well as desired topics for future instruction. Open-ended feedback about reactions to the sessions was solicited as well. Of 56 participants, 29 took the survey for a response rate of 52%. Respondents included 22 residents and 7 faculty. All participants (100%) reported improved understanding of diversity within the workplace. The majority (94%) found the sessions very or extremely useful. Survey respondents requested further training in related topics, including addressing discrimination from patients (83%), best practices in hallway care (83%), and implicit bias (59%). Two major themes were identified. The first was a need for continued discussion. The second was a desire for involvement of other key stakeholders, including faculty and nursing.

The health equity retreat was effective at promoting residents' and faculty members' awareness of racism in the workplace. Sharing of residents' experiences followed by facilitated reflection was well received in each session. The retreat format aligns with the educational theory of experiential learning, in which concrete experience forms the basis for reflection, which in turn motivates changes in one's approach to future actions or situations.¹¹

Limitations in assessment of the retreat included low survey response rate and the fact that outcomes measured were self-reported, rather than indicative of attainment of learning objectives. However, an important lesson learned from the retreat was that this type of event created an opening for conversations about race and racism in EM, which resident and faculty participants have repeatedly reflected to the retreat organizers outside of the survey since the event.

The inaugural retreat led into a longitudinal health equity curriculum occurring over the rest of the academic year. This curriculum has included a series of lectures, panels, and journal clubs about health disparities and equity in the local practice environment, the evaluation of which is ongoing. Notably, not all residencies have affiliated members with backgrounds in race theory, and we suggest collaborating with educators with topical expertise as we are doing in the continued curriculum. Additionally, this one-time survey did not gauge long-term effectiveness of the workshop. For the next residency health equity retreat, we plan to perform surveys before, and at one and three months after the event, to improve understanding of the event's longer term effects on self-reported behaviors. Future research is needed to understand how this retreat and similar educational efforts impact individuals' behaviors toward colleagues and patients.

Address for Correspondence: Anita N. Chary, MD, PhD, Harvard Affiliated Emergency Medicine Residency, 5 Emerson Place, Suite 101, Boston, MA 02114. Email: anita.chary@mgh.harvard.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Implementation of a Physician Assistant Emergency Medicine Residency Within a Physician Residency

Alina Tsyruunik, MD
Katja Goldflam, MD
Ryan Coughlin, MD
Ambrose H. Wong, MD, MEd
Jessica M. Ray, PhD
Jessica Bod, MD
Sharon Chekijian, MD
David Della-Giustina, MD

Yale University School of Medicine, Department of Emergency Medicine, New Haven, Connecticut

Section Editor: Abra Fant, MD

Submission history: Submitted July 13, 2020; Revision received November 19, 2020; Accepted November 20, 2020

Electronically published December 14, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.49052

Physician assistants (PA) are an important part of emergency department healthcare delivery and are increasingly seeking specialty-specific postgraduate training. Our goal was to pilot the implementation of a PA postgraduate program within an existing physician residency program and produce emergency medicine-PA (EM-PA) graduates of comparable skill to their physician counterparts who have received the equivalent length of EM residency training to date (evaluated at the end of first year of EM training).

The curriculum was based on the Society for Emergency Medicine Physician Assistants (SEMPA) recommendations with a special focus on side-by-side training with EM resident physicians. In reviewing the program, the authors examined faculty evaluations, as well as procedure and ultrasound experience that the trainees received. We found comparable evaluations between first-year EM-PA and physician trainee cohorts. This program serves as a pilot study to demonstrate the feasibility of collocating clinical and didactic programming for physicians and EM-PAs during their postgraduate training. This brief innovation report outlines the logistics of the clinical and didactic curriculum and provides a summary of outcomes evaluated. [West J Emerg Med. 2021;22(1)45-48.]

BACKGROUND

Physician assistants (PA) are an important part of the modern emergency department (ED), facilitating the practice of emergency physicians and serving as independent providers of patient care.^{1,2} Traditionally, PA education relies on experience gained in clinical rotations and postgraduate “on-the-job” practice. Increasing ED patient volumes and acuity burden providers and the healthcare system,³ compelling EDs to hire PAs to assist in providing emergency care. The breadth of knowledge required to manage diverse and high-acuity patients in EDs has led to the development of EM-PA residencies.

Research shows that collaborative healthcare teams decrease cost, improve patient satisfaction, and reduce morbidity and mortality through enhanced patient safety and reduction in errors. At the same time, interprofessional

teams improve overall provider satisfaction and professional relationships.⁴ To promote this team-based approach in clinical care, the Institute of Medicine recommends an interprofessional model in healthcare education.⁴ Interprofessional education is rooted in situated learning theory, where a community of practice helps foster collaborative learning across professional silos.⁵ Medical education has increasingly focused on such interprofessional team development.⁶ In 2009, several medical profession education governing bodies, including the Association of American Medical Colleges, created the Interprofessional Education Collaborative to encourage and promote interprofessional learning experiences.⁷ The model of PA residency education presented here similarly applies this interprofessional framework.

The United States currently has 49 clinical postgraduate EM-PA training programs.⁸ There are diverse durations, curricula, geographic and demographic clinical settings (academic vs community), patient populations, and volume. Most importantly, the focus and goals of these programs vary.⁹

OBJECTIVES

The goal of the program presented here was to pilot an implementation of PA postgraduate training embedded within the existing educational infrastructure of an EM residency program. Both PA and physician trainees engage in identical clinical and academic responsibilities together. Through this unique approach of collocating both trainee groups within the same educational milieu, EM-PA residents engage in identical clinical and academic activities as their physician resident counterparts.

CURRICULAR DESIGN

This program was established at a Level I trauma, quaternary care referral center with an existing four-year physician residency consisting of 15 physician residents and two PA residents per class. The logistics of recruiting and credentialing of PA providers were similar to that of hiring non-resident PA providers and was based on institutional guidelines as well as best practices described in literature.¹⁰ The university institutional review board approved our work as an exempted study.

Following the 2012 Society for Emergency Medicine Physician Assistants (SEMPA) recommendations,¹¹ we established the EM-PA residency in 2015 as an 18-month program consisting of one- to four-week rotations (Figure 1A). All rotations were identical to the physician residency with the exception of one additional, four-week rotation at an affiliated freestanding ED for the PAs. The didactic curriculum included lectures, immersive simulation, reading assignments with associated quizzes, and an “EM Fundamentals” program.¹² EM-PA residents completed a Rosh Review mock in-training examination, mock oral board examinations, cadaver lab, and airway training, and were members of quarterly wellness team meetings. Both trainee groups participated in all didactic, clinical, and residency-run social experiences together.

During all rotations, EM-PA residents functioned as primary team members. They worked alongside attending physicians with the same responsibilities as their EM postgraduate year 1 (PGY-1) (for the first 12 months of EM-PA training) or PGY-2 (for months 12-18 of EM-PA training) physician counterparts who were at the same point in their EM training. EM-PA residents also maintained procedure and ultrasound logs (Figure 1B).

IMPACT/ EFFECTIVENESS

The program’s effectiveness and breadth of PA training was reflected in a number of parameters, including evaluations and procedure and ultrasound logs. We assessed for program feasibility by filling of available trainee positions in subsequent

years, and retention of graduating EM-PAs in the field of EM immediately upon program completion.

Resident evaluations were collected at the end of the first year of EM training via an online software tool (Qualtrics XM, Provo UT) implemented in 2016 for both trainee groups.¹³ The tool uses a 5-point Likert scale to measure proficiency in EM-specific competencies that are loosely based on the EM Milestones.¹⁴ Means and standard deviations show similar scores for faculty evaluation of first-year physician and EM-PA residents’ performance during ED rotations between July 2017–July 2020 (Figure 1C). Limitations in these evaluation results include the fact that the evaluation tool randomly selects two questions, leading to inconsistent numbers of attending physician evaluations of various competencies. Further, each year only consisted of two PA trainees, thus limiting the ability to draw statistically significant conclusions. However, a descriptive similarity in scores can be observed.

PA residents had experience in all procedures and ultrasounds expected (Figure 1B). Similar to physician residents, PA residents performed some of the rare procedures, such as cricothyrotomy, in a cadaver lab or at the simulation center. It is important to note that the use of faculty evaluations, as well as procedure and ultrasound numbers, are only some of the many means of comparing the two trainee groups. Future investigation would need to aim at comparing other educational outcome measures.

Since its inception, the two positions available in the PA residency were filled each year. In the current academic year 2020-2021, the program increased to four positions per year. Upon graduation, all PA residents secured clinical positions in EM.

Several EM-PA residencies exist, with prior publications outlining best practices in the logistics of some of these programs.¹⁰ Although a recent cross-sectional study of EM-PA residencies identified that 93% of programs were in institutions that also had an EM residency program, it is unclear how the educational programs of their PA residents interacted with their respective MD residents.² The aim here was to describe an EM-PA residency collocated and embedded within an existing physician residency and demonstrate the feasibility of this interprofessional approach to EM-PA postgraduate training.

It is important to note that the PA residency is 18 months long, in accordance with SEMPA recommendations. Graduates’ knowledge is not exhaustive, and on-the-job training after residency remains critical. The program, as designed, is not meant to provide PA trainees with the same level of training as EM residents upon residency completion. For that reason, the evaluation comparisons provided here are at the PGY-1 level. Finally, although there is much evidence supporting the benefits for integrated interprofessional education⁴ for enhancing teamwork and communication skills, this endpoint was not evaluated.

The structure of this program can be replicated across other EDs. Investigation should continue in evaluating the efficacy of

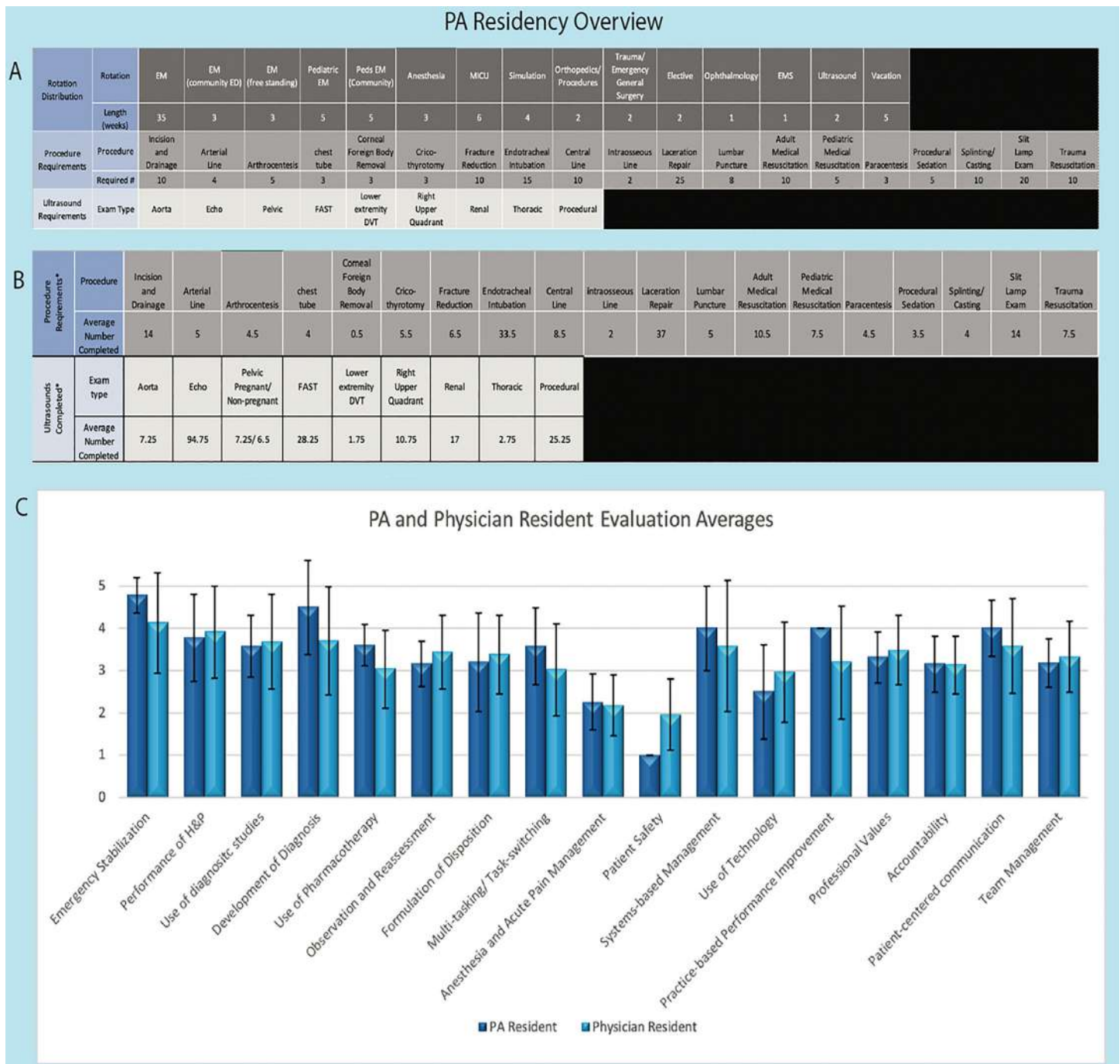


Figure 1. Overview of emergency medicine physician assistant residency. A. Format of the physician assistant (PA) residency: rotation description and length; procedure requirements; ultrasound requirements. B. Average (3 years of trainees) of procedures and ultrasounds completed by PA residents. C. PA and physician resident evaluations averages (and standard deviation) on 5-point Likert scale evaluated by attending physicians (average of 3 years of trainees). The evaluations are of EM-PA and EM-physician residents in their first year of EM residency training. PA, Physician Assistant; EM, emergency medicine; EMS, emergency medical services; FAST, focused assessment with sonography for trauma; DVT, deep vein thrombosis; H&P, history and physical.

this approach with higher numbers of graduates and more years of follow-up. Analyses of team management and communication skills as outcomes of such programs is needed. Although the authors intend to formally explore how the PA and physician

residents feel about this interprofessional approach, the anecdotal response of both groups of learners has been predominantly positive. Despite the fact that the addition of PA residents has increased the number of learners in the department, our

faculty, patient, and procedure numbers are able to support the additional trainees. In the authors' experience, through informal observations and discussions with the residents, the fact that both groups share orientation, didactics, and social events from the moment they start residency, has contributed to their positive experience in clinical teamwork and colocation in the ED. From early experience, it stands to reason that the combination of adequate patient, procedure, and supervision availability in the clinical setting combined with outside educational experiences (didactics, simulation, reading assignments) and social events, allowed these two groups of learners to achieve a positive learning experience. With further study and evaluation, training PAs and physicians together clinically and in the classroom may prove effective in graduating well-trained, extremely competent and highly recruited EM-PAs.

ACKNOWLEDGEMENTS

The authors would like to acknowledge all staff who aided in the effort to better medical education. We would like to acknowledge PA Kevin Burns, the Director of the PA residency for his great dedication to the educational mission of our PA residency, and for helping contribute data to this project. We sincerely acknowledge and thank Mr. Justin Laing in the preparation and illustration of our manuscript figure. We also thank Alexandria Brackett for her assistance in the literature review used for preparation of this work.

Address for Correspondence: Alina Tsyurulnik, MD, Yale University School of Medicine, Department of Emergency Medicine, 464 Congress Ave, New Haven, CT 06519. Email: alina.tsyurulnik@yale.edu.

Conflicts of Interest: By the *WestJEM* article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Response to “Implementation of a Physician Assistant Emergency Medicine Residency Within a Physician Residency”

Alina Tsyruunik, MD
Katja Goldflam, MD
Ryan Coughlin, MD
Jessica Bod, MD
Sharon Chekijian, MD
David Della-Giustina, MD

Yale University School of Medicine, Department of Emergency Medicine, New Haven,
Connecticut

Section Editor: Mark I. Langdorf, MD, MHPE

Submission history: Submitted December 22, 2020; Accepted December 23, 2020

Electronically published December 23, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.51312

[West J Emerg Med. 2021;22(1)49.]

Dear Editor,

We, the authors of the paper: “Implementation of a Physician Assistant Emergency Medicine Residency Within a Physician Residency” (West J Emerg Med. 2020 Dec 14;22(1):45-8) would like to address concerns raised by members of the emergency medicine (EM) community. Our article describes the successful implementation of a physician assistant (PA) training program within the existing framework of an EM residency. This article was submitted as a “brief educational advance.” It is a description of the logistics of our program and was not powered to draw any statistical conclusions on the limited data of an evaluation tool lacking validation, as was pointed out in the limitations. It does not support or suggest the equivalence of physician graduates of a 3- or 4-year residency in emergency medicine with PA training program graduates. As such, it does not seek to equate the two programs or the skills of their respective graduates, but instead to describe a successful interprofessional educational collaboration.

Further, we want to make it clear that due to our high ED patient volume, including multiple training sites, our physician trainees have not had a decrease in patient or procedure exposure. Our advanced practice provider (APP) trainees present all patients to our senior residents and/or attendings expanding opportunities within our department for interprofessional teamwork. The implementation of a similar program must pay attention to these details in order to ensure optimal training for its physician residents.

This paper is not a commentary on the economics and workforce issues currently facing emergency medicine. Nor is it a substantiation for expanded scope of practice of APPs beyond their intended training. The authors do not wish this

work to be used to further political agendas that we do not support. To that end, we would like to explicitly state the following:

1. APPs in emergency medicine should work with the supervision of an EM specialty-trained physician.
2. Patients should be cared for by EM physician-led teams in the emergency department.

We believe in enhancing our residents’ leadership training through their exposure to interprofessional team dynamics while optimizing our APP trainees’ clinical skills in the interest of excellent patient care. We are proud of the collaborative educational programs we have developed and of all our graduates and current trainees.

Address for Correspondence: Alina Tsyruunik, MD, Yale University School of Medicine, Department of Emergency Medicine, 464 Congress Ave, New Haven, CT 06519. Email: alina.tsyruunik@yale.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Transitioning Traditions in the Time of COVID

Michelle E. Romeo, MD
Jeremy Branzetti, MD

New York University, Bellevue Hospital, Department of Emergency Medicine, New York City, New York

Section Editor: Andrew Phillips, MD, MEd

Submission history: Submitted July 14, 2020; Accepted December 14, 2020

Electronically published December 22, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.49118

[West J Emerg Med. 2021;22(1)50-51.]

In 1979 Drs. Lewis Goldfrank and Neal Lewin astutely perceived that the Bellevue Hospital emergency ward, the safety net of New York City, provided an exceptional learning environment for patient care. Every patient, in some capacity, was deemed an invaluable educational opportunity, and through this ideology the tradition of “Morning Report” was born. It would become a staple of the residency, and the department community as a whole, for the next 40 years.

Morning Report is a time-protected group learning experience led by a senior resident discussing a prior patient case. Learners in attendance are the students, residents, and attendings scheduled clinically for that day. Using the patient’s presentation, chief complaint, initial vital signs and physical exam, the resident strategically guides the learners through the case. Frequent pauses and active group engagement are used to generate a differential diagnosis, and seasoned providers discuss what their next steps would be given their knowledge of the details thus far. The tangential conversations that are sparked from the case allow trainees to understand the thought process that seasoned attendings use for patient care. The case usually ends with a discussion of the final diagnosis and best practices for us as providers. It is mostly during this time that learners sip on their coffee with wide eyes at the decades-old Bellevue conference table. It is also not uncommon to find attendings lingering behind to reminisce on prior cases or experiences that also left an impression on them or to learn a little bit more about the newest intern they meet that day. It was our opportunity to truly learn who our colleagues are that make up the community we are housed in.

Over the years, Morning Report has become so ingrained in the departmental culture that nursing and attendings provide clinical coverage during the early hour to protect time for learning. In the era of COVID-19, department volumes and acuity surged and our ability to take an hour away from shift was untenable. This, tied with the unwelcoming truth that our department could no longer gather in groups safely, led to a loss of an educational tool vital to our residency program and to our sense of community. With New York quickly becoming an epicenter of the early pandemic, web-based video conferencing became the new normal and the decision

was made to trial Morning Report online. Using the platform of Zoom (Zoom Video Conferencing Inc., San Jose, CA), we recreated as much of the format as possible. Scheduling and clinical volumes necessitated moving away from morning learning; thus, a thrice-weekly “Evening Report” was born that would ultimately last eight weeks and carry us through dark, isolating nights of the pandemic.

While our cherished tradition of in-person learning was disrupted, we quickly realized the upside of remote connection: for the first time ever, those at affiliated sites, including advanced practice providers and nurses, were able to attend and learn alongside the residents. Alumni, who normally were just out of reach, returned “home” from all over the country to rebuild a new learning community with us. The new reality, while beneficial and relatively easy to implement, required adaptations. Residents, overwhelmed with the pandemic’s physical and emotional workload, were not expected to have much bandwidth to carry on another task. Instead of scheduling specific session leaders, a volunteer system was established. The expectation for slides and in-depth preparation was eschewed to promote on-the-spot learning that required minimal preparation. Volunteer leaders were only asked to bring a few details of the case to the table and allow the community to take over the discussion.

Our longtime facilitator, Dr. Lewin, was present at every evening report. This allowed at least one faculty member with decades of experience to help facilitate teaching. The sessions usually concluded with a comment from Dr. Goldfrank regarding best practices and summarizing our continued duties within this pandemic. Alumni eagerly stepped up to shoulder the teaching burden, asking to step in to fill in gaps, letting us know participation in this beloved tradition of their alma mater was not only wanted but savored. Inevitably, just like our in-person times, many hung around after the assigned presentation to check in with each other, socialize, and tell stories. Although slotted for an hour, the sessions would easily reach almost two hours. Alumni, attendings, and residents lingered to become more acquainted and reconnect with each other, recount stories of patient care, or simply share a virtual drink.

Participation was remarkable, with just over eight weeks at three sessions a week. Tradition was reborn. Anywhere from 20-50 participants attended each session. We learned that “Evening Report” was more than just a virtual adaptation of a long-standing tradition. Having a scheduled and protected educational event nightly brought back a sense of normalcy in a world that looked like nothing we had known. Being able to reconnect the department, affiliated sites, and alumni allowed the educational community not only to continue on but to flourish and grow.

Social isolation took a toll on us, with many having to be away from their families and friends. No gym class or department happy hour was available to heal the community or bring us together. So, while the initial intention of “Evening Report” was to carry on a tradition of those who have walked Bellevue’s halls for many years, it became a much more important venue for us to reconnect and support each other through a harrowing time of our medical careers. It became a

time to come together to create true community wellness in a time of need. The “conference table” was back and allowed for more seats at the table than ever expected.

Address for Correspondence: Michelle E. Romeo, MD, New York University, Bellevue Hospital, Department of Emergency Medicine
Name, address. Email: michelle.e.romeo@gmail.com.

Conflicts of Interest: By the *WestJEM* article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Does a Standardized Discharge Communication Tool Improve Resident Performance and Overall Patient Satisfaction?

Michael T. Dalley, DO
Mauricio J. Baca, MD
Chandelle Raza, DO
Laurie Boge, DO
David Edwards, MD
Robert Goldszer, MD
Luigi Cubeddu, MD
David Farcy, MD

Mount Sinai Medical Center, Department of Emergency Medicine, Miami Beach, Florida

Section Editor: Abra Fant, MD

Submission history: Submitted June 5, 2020; Revision received September 13, 2020; Accepted September 17, 2020

Electronically published November 20, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.9.48604

Introduction: The discharge conversation is a critical component of the emergency department encounter. Studies suggest that emergency medicine (EM) residency education is deficient in formally training residents on the patient discharge conversation. Our goal was to assess the proficiency of EM residents in addressing essential elements of a comprehensive discharge conversation; identify which components of the discharge conversation are omitted; introduce “DC HOME,” a standardized discharge mnemonic; and determine whether its implementation improved resident performance and patient satisfaction.

Methods: This was a prospective observational pre- and post-intervention study done by convenience sampling of 400 resident discharge encounters. Resident physicians were observed by attending physicians who completed an evaluation, answering “yes” or “no” as to whether residents addressed six components of a comprehensive discharge. The six components include the following: diagnosis; care rendered; health and lifestyle modifications; obstacles after discharge; medications; and expectations – or “DC HOME.” Didactics introducing the mnemonic “DC HOME” was provided to resident physicians. Patient feedback and satisfaction were collected after each encounter, and we recorded differences between pre-intervention and post-intervention encounters.

Results: Resident physicians improved significantly in all six components of “DC HOME” from pre-and-post intervention: discharge diagnosis ($P = 0.0036$) and the remaining five components ($P < 0.0001$). There was a statistically significant improvement in patients’ perception for health and lifestyle modifications, obstacles after discharge, medications, expectations after discharge ($P < 0.0001$), and discharge diagnosis ($P = 0.0029$). Patient satisfaction scores improved significantly ($P = 0.005$). Time spent with patients during discharge increased from 2 minutes and 42 seconds to 4 minutes and 4 seconds ($P < 0.0001$).

Conclusion: EM residents frequently omit key components of the discharge conversation. The implementation of the “DC HOME” discharge mnemonic improves resident discharge performance, patient perception, and overall patient satisfaction. [West J Emerg Med. 2021;22(1)52-59.]

INTRODUCTION

The discharge conversation is a critical component of the emergency department (ED) encounter. Risks of not performing a comprehensive discharge include recidivism, medical errors, adverse drug events, and malpractice liability.¹⁻⁴ At discharge, patients and their caregivers have an important role in ensuring a successful transition of care. Assumption of this responsibility has proven to be a source of anxiety for patients and their caregivers, whether from lack of understanding and preparation for the self-care role, confusion due to conflicting practitioner advice, a sense of abandonment, and/or a feeling of overall disregard for their preferences and input.^{5,6} Quality discharge instructions have proven to maximize the likelihood patients will fill their prescriptions, be compliant with medications, improve compliance with ED recommendations, and avoid unnecessary adverse complications.⁷⁻⁹

Despite this, a standardized method to consistently perform a comprehensive and effective patient-centered discharge from the ED is lacking. Vashi et al suggest integral components of the discharge conversation should include explanation of symptoms and expected course of illness, instructions about medications and self-care, and instructions about symptoms that should prompt return to the ED.¹⁰ Rhodes et al similarly suggested diagnosis, expected course of illness, self-care, use of medications, time-specified follow-up, and reasons to return to the ED as important aspects of the discharge conversation, and they found that in nearly 45% of discharges, emergency medicine (EM) residents were remiss in relaying this critical information.¹¹

EM residency education is deficient in formally training and assessing residents on the patient discharge discussion. A 2015 survey of 119 Accreditation Council for Graduate Medical Education (ACGME)-accredited EM programs conducted by the Council of Emergency Medicine Residency Directors (CORD) found that 73.9% of EM programs do not evaluate residents on competency in performing effective discharges.¹³ It also noted that while only 42.9% of programs provided formal instruction on the discharge process during orientation, a mere 5.9% of programs had structured training beyond this initial orientation period.¹³

In this study, we introduce “DC HOME,” which stands for patient’s discharge diagnosis; the care rendered including test results; health and lifestyle modifications; obstacles after discharge; information regarding prescribed medications; and expectations regarding patient diagnosis with follow-up plans after discharge. We hypothesized that formalized education introducing and implementing the use of the “DC HOME” mnemonic during the discharge conversation would consistently address essential elements of aftercare responsibility and would ameliorate the frequency of patients being discharged with inadequate instructions.^{11,14}

METHODS

The aims of this study were four-fold: 1) to assess

Population Health Research Capsule

What do we already know about this issue?

The discharge conversation is a critical component of the emergency department (ED) encounter. Emergency medicine residency education is deficient in formally training and assessing residents on the patient discharge conversation.

What was the research question?

Can formal education and the use of “DC HOME”, a standardized discharge mnemonic, improve resident performance and patient satisfaction during the discharge conversation?

What was the major finding of the study?

The implementation of the “DC HOME” discharge mnemonic improves resident discharge performance, patient perception, and overall patient satisfaction.

How does this improve population health?

Quality discharge instructions have proven to maximize the likelihood patients will fill their prescriptions, be compliant with medications, improve compliance with ED recommendations, and avoid unnecessary adverse complications.

the proficiency of EM residents in addressing essential elements of a comprehensive discharge plan during the discharge conversation; 2) to identify which components of the discharge conversation are repeatedly omitted; 3) to introduce “DC HOME,” a protocolized discharge mnemonic, into EM resident education; and 4) to determine whether its implementation would improve resident performance and patient satisfaction.

This prospective observational before-and-after study was conducted at a Level III trauma, urban, academic ED with a 60,000-annual visit (30% admission rate) in Miami Beach, Florida. The EM residency program is a three-year, ACGME-accredited program with seven resident physicians per year. Prior to this study, the study site used an electronic health record (Epic, Verona, WI) for note documentation, and provided diagnosis-specific, printed discharge instructions to each patient with instructions provided by an ED provider (emergency physician, advanced practice provider, or nurse) involved in the care of the patient. A convenience sample of 400 resident discharge conversations were observed by our EM residency clinical faculty (18 total, four of whom are authors of this study), 200 of which were completed pre-intervention and 200 post-intervention. We collected data from November 2018–June 2019 of the academic year, observing the same cohort of 21 residents. Pre-intervention

observations took place from November 2018–January 2019. Post-intervention observations took place one week after a 30-minute didactic session from mid-February 2019–June 2019. Inclusion criteria included adult patients who were being discharged from the ED. Exclusion criteria included patients with altered mental status, less than 18 years of age, non-English speaking, and individuals who refused to participate. Observations took place any time within a 24-hour day/7 days per week schedule.

Prior to the pre-intervention phase of the study, the authors performed a thorough literature search¹⁰⁻¹³ identifying essential components of a discharge conversation and incorporated this data with survey question outcomes data from the hospital site's ED patient satisfaction survey provider (National Research Corporation Picker Survey, Lincoln, NE). Themes ascribed from this information led to a contributing authors' consensus, which identified six essential components that should be addressed in a comprehensive discharge conversation (see Appendix 1). Each component represents a letter in the "DC HOME" mnemonic created by the authors of this study and introduced in the intervention didactic session.

In the pre-intervention phase of the study, clinical faculty emergency physicians were instructed to observe the discharge encounter between resident physician and patient. A binary questionnaire was provided and the faculty were instructed to answer "yes" or "no" if a resident discussed each of the study-defined six components of the comprehensive discharge conversation. Faculty were provided with specific examples within the body of the survey questionnaire to provide a scoring reference for successful completion (see Appendix I). Satisfactory fulfillment of each criterion was based on the investigating attending physician's subjective opinion and experience along with the application of the predefined examples of what constitutes a successful acknowledgement of a specific component. If a defined component of the questionnaire was not applicable (ie, a diagnosis that did not require medications at discharge), faculty were instructed to score "yes" if the resident mentioned the component (ie, "no new medication is required today") or "no" if the component was not brought up in the discharge conversation at all.

The start and end time of the resident physician discharge conversation was recorded. When the resident physician was done discharging the patient, the clinical faculty member would stay behind in the room and ask the patient the same six questions to evaluate patient perception of the discharge conversation. Lastly, patients were asked about their overall satisfaction with the discharge conversation.

After the pre-intervention phase of the study was completed, a 30-minute lecture consisting of a PowerPoint (Microsoft Corp., Redmond, WA) presentation with background information regarding what constitutes a comprehensive discharge¹⁰⁻¹³ and introduction of "DC HOME" incorporating the six components of the comprehensive discharge plan was presented at the EM weekly didactic

conference where all resident physicians were present. The lecture was followed by a practical, in which each resident present was paired with a co-resident. Each were given three mock-patient encounters with a discharge diagnosis and asked to perform mock discharge conversations on each other, first using their current usual practice and then repeated using "DC HOME." These mock discharges were observed by the principal investigators present at conference, and feedback regarding areas of improvement in their usual practice and the impact of using the discharge tool was shared with each resident. Residents were instructed to start using "DC HOME" with all future ED discharges. The didactic session made no mention that this intervention was part of an ongoing study. Residents were informed that they would be observed performing discharge conversations after the lecture.

Post-intervention, clinical faculty observed the discharge conversation between the resident physician and patient and completed the same questionnaire as the pre-intervention phase of the study. Clinical faculty, with the exception of the study authors, were unaware that an education session introducing "DC HOME" had taken place prior to the post-intervention phase. The start and end time of the resident physician discharge conversation was recorded. Again, the patients were then asked the six questions alone by the clinical faculty to evaluate patient perception. Clinical faculty then asked patients about satisfaction of the discharge conversation.

Results of "DC HOME" were shown as number of observations of "yes" or "no" with mean percentages for each of the six discharge components. We calculated differences between pre-intervention and post-intervention using Fisher's exact test. *P*-values equal to or less than 0.05 were considered significant. Patient satisfaction was resulted as "not satisfied," "somewhat satisfied," and "very satisfied." Differences were calculated by using Fisher's 2 x 3 variant test. Time spent on the discharge process was recorded with each observation and pre- and post-intervention were compared using the unpaired t-test since individual residents were not recorded for each discharge encounter. The study was powered (Type II error 0.2) to detect an effect size of 28.1% with a type I error of 0.05. The study was approved by the hospital's institutional review board.

RESULTS

Pre-intervention, resident physicians were observed to have a total of 784 "yes" responses and 416 "no" responses for all six "DC HOME" criteria. Resident physicians during the pre-intervention period discussed diagnosis 95.5% of the time, care rendered 88.5% of the time, medications 80.5% of the time, and expectations 81% of the time. The categories residents mostly omitted were health and lifestyle changes and obstacles after discharge, with health and lifestyle changes 24% of the time and obstacles after discharge 22.5% of the time. In the post-intervention period, resident physicians were observed to have a total of 1193 "yes" responses and

7 “no” responses; thus, significant improvement was found ($P < 0.0001$). All six individual components of the discharge instructions showed statistically significant improvement from pre-intervention to post-intervention (refer to Table 1).

Patient perception of the resident discharge conversation at pre-intervention had a total of 921 “yes” responses and 279 “no” responses for all six “DC HOME” criteria. Patients understood diagnosis 94.4% of the time, care rendered 99% of the time, health and lifestyle changes 53.8% of the time, obstacles after discharge 47.2% of the time, medications 78.4% of the time, and expectations 86.9% of the time. The weakest categories were health and lifestyle changes, obstacles after discharge, and medications. Post-intervention for the 6 “DC HOME” components there were a total of 1139 “yes” responses and 61 “no” responses; thus, significant improvement was found ($p < 0.00001$). Patient perception showed statistically significant improvements in all six individual components except care rendered, which showed only slight improvement from 99% to 99.5% ($P = 0.6231$) (refer to Table 2).

Patient satisfaction improved from pre-intervention to post-intervention: 85% of patients were “very satisfied” pre-intervention, and 98% of patients’ post-intervention who received “DC HOME” instructions were “very satisfied” (Table 3).

The average amount of time spent with patients on

discharge instructions was 2 minutes and 42 seconds in the pre-intervention group and 4 minutes and 4 seconds in the post-intervention group. This represented a 66% increase in time spent on discharge communication and was statistically significant ($P < 0.0001$) (Table 4).

DISCUSSION

The results of this study emphasize that residents underperform in addressing key elements of the discharge conversation. Implementation of a standardized communication tool “DC HOME” significantly improved resident performance during the discharge conversation. The use of the “DC HOME” mnemonic also improved patients’ perception regarding a resident physician’s performance during discharge and overall patient satisfaction.

During the pre-intervention phase, in more than 76% of encounters, resident physicians did not ask their patients about obstacles to further care, such as affording medications or transportation to follow-up visits and did not receive education on health and lifestyle modifications, such as quitting tobacco use or improving their diet. Nearly 20% of the time, residents did not provide patients with information regarding newly prescribed medications and did not provide patients with expectations following discharge, including expected course of illness and reasons to return to the ED. These findings may be attributed to a

Table 1. Attending emergency physicians’ observations of residents’ discharge discussions with patients.

	Physician observation PRE		Physician observation POST		P-values
	Answer choices	Responses	Answer choices	Responses	
Diagnosis					
Yes		191 (95.5%)	Yes	200 (100%)	0.0036
No		9 (4.5%)	No	0 (0%)	
Care rendered					
Yes		177 (88.5%)	Yes	200 (100%)	<0.0001
No		23 (11.5%)	No	0 (0%)	
Health/lifestyle changes					
Yes		48 (24%)	Yes	193 (96.5%)	<0.0001
No		152 (76%)	No	7 (3.5%)	
Obstacles after discharge					
Yes		45 (22.5%)	Yes	200 (100%)	<0.0001
No		155 (77.5%)	No	0 (0%)	
Medications					
Yes		161 (80.5%)	Yes	200 (100%)	<0.0001
No		39 (19.5%)	No	0 (0%)	
Expectations					
Yes		162 (81%)	Yes	200 (100%)	<0.0001
No		38 (19%)	No	0 (0%)	

Differences between pre- and post-intervention were analyzed with Fisher’s exact test. P-values ≤ 0.05 were considered as statistically significant.

“lack of standardized formal training and evaluation which is not the norm at most emergency medicine training programs as well as a limitation of education priorities based on perception and belief that senior residents are competent.”¹³

Implementation of “DC HOME” allows a platform for faculty to assess a resident’s performance and provide feedback after direct observation. Prior studies have shown that the use of direct observation as a formal evaluation of EM residents is valuable to their education, identifies areas requiring improvement, and that the presence of faculty evaluators is not overly intimidating.¹⁵ The ACGME Milestones project has encouraged the implementation of bedside assessments as a means of ensuring clinical competency.¹⁶ Implementation of “DC HOME” will provide another tool in resident performance evaluation.

ACGME guidelines for EM residents stress effective patient communication as a core competency.¹⁶ The ACGME requires formal education in patient handoffs.¹⁷ The discharge conversation is a perfect opportunity to evaluate this core competency.¹⁶⁻¹⁸ In an effort to reduce errors, communication training and the use of mnemonics to standardize transfer of critical information have been recommended.¹⁹⁻²¹ When used in clinical practice, the I-PASS mnemonic (illness severity; patient summary; action list; situation awareness; synthesis) and the I-PASS study group proved that implementation of

these recommendations when turnover of patient care between physicians occurs can significantly reduce medical errors and rate of adverse events among hospitalized patients.²² The magnitude of the discharge conversation is similar to a patient handoff from physician to physician, with the difference that the responsibility of care is transferred directly to the patient.²³⁻²⁶ Our study illustrates a significant improvement in the ability of a resident physician to address the most important components necessary to safely transfer care back to the patient. Future studies may look to address “DC HOME” and its impact on recidivism, medical errors, adverse drug events, and malpractice liability.¹⁻⁴

Use of the “DC HOME” mnemonic resulted in a statistically significant improvement in overall patient satisfaction (Table 3). Currently healthcare is a competitive business market where healthcare business models, which include value-based incentives, gauge patient satisfaction to improve quality, retain patients and gain market share. In EM, it has been shown that the quality of discharge instructions improves patient satisfaction.²⁷⁻³¹ The time spent in communication between the patient and resident physician increased roughly 66% between our pre-intervention and post-intervention groups. Although there was a statistically significant increase in time spent, it aligns with the results of a similar study by Vashi et al, which had an average amount of time spent during discharge of about four minutes.¹⁰

In our study we recognize that time management and

Table 2. Patient perceptions of resident physicians’ discharge instructions in the emergency department.

	Patient responses PRE		Patient responses POST		P-values
	Answer choices	Responses	Answer choices	Responses	
Diagnosis					
Yes		189 (94.5%)	Yes	199 (99.5%)	0.0029
No		11 (.5%)	No	1 (0.5%)	
Care rendered					
Yes		198 (99%)	Yes	199 (99.5%)	0.6231
No		2 (1%)	No	1 (0.5%)	
Health/lifestyle changes					
Yes		108 (54%)	Yes	175 (87.5%)	<0.0001
No		92 (46%)	No	25 (12.5%)	
Obstacles after discharge					
Yes		95 (47.5%)	Yes	178 (89%)	<0.0001
No		105 (52.5%)	No	22 (11%)	
Medications					
Yes		157 (78.5%)	Yes	192 (96%)	<0.0001
No		43 (21.5%)	No	8 (4%)	
Expectations					
Yes		174 (87%)	Yes	196 (98%)	<0.0001
No		26 (13%)	No	4 (2%)	

Differences between pre- and post-intervention were analyzed with Fisher’s exact test. P-values ≤ 0.05 were considered as statistically significant.

efficiency is crucial in emergency physicians' workflow; however, the extra 1 minute and 36 seconds spent in patient/provider discharge communication will align with the patients' needs and preferences as well as help improve resident competency in important elements of interpersonal skills and performance with communication.¹⁷

LIMITATIONS

The main potential limitation to this study was investigator bias, where four authors included in the faculty observers (18 total) cohort performed pre- and post-intervention observations. We recognize that knowledge of the education intervention may have skewed the results toward impact benefit. However, the authors represented only 22% of total observers and performed 46 total observations (20 pre/26 post), which constitutes a small percentage of the sample size. While relevant, this potential bias would have no bearing on the patient perception and patient satisfaction results, which showed improvement.

Another potential limitation is observer bias, whereby resident physicians may have altered their behaviors (consciously or unconsciously) during the discharge process because they were aware that they were being observed. The observer bias may have been more far reaching post-intervention as the residents were

aware they were being evaluated on their discharge conversation skills and their ability to implement the "DC Home" mnemonic into their discharge conversation. Future studies can attempt to assess how residents performed with other patients when they were not being observed by faculty.

Satisfactory fulfillment of each discharge component criteria was based on the investigating faculty subjective opinion, limiting the ability to define formal standardized criteria for each of the six components of the discharge discussion, which could have led to confirmation bias, social desirability bias, and acquiescence bias. In an attempt to mitigate these limitations, faculty were provided with example phrases within the questionnaire that if mentioned would constitute a successful acknowledgment of the specific component of the discharge conversation being observed. (Appendix 1). Institution of an inter-rater reliability review and calculation process would have also addressed this limitation; however, this was not included in the study design.

The discharge diagnosis may have been a factor in determining the proficiency of the discharge encounter. For instance, an otherwise healthy young patient with acute pharyngitis may not have received or required a conversation about health and lifestyle modifications and obstacles after discharge; thus, providing a "not applicable" choice option within the questionnaire would have been more inclusive of the variety of discharge diagnoses provided in an ED encounter. This omission may have had an effect on final statistical analysis. While this may be considered a limitation, the binary design of the questionnaire assessed residents' attempts to make mention of all six components of the discharge mnemonic despite the possibility of a certain component not being applicable. Regardless of the possibility of a component not being applicable, it is our opinion that instruction, repetition, and implementation of a protocolized approach to consistently consider all six components of the "DC HOME" mnemonic will give resident physicians the framework to consistently deliver a comprehensive discharge conversation.

Lastly, the resident's level of training was not accounted for. All discharge observation evaluations were performed and interpreted independent of level of training. In doing so, data on discharge instructions by level of training was not available, and perhaps those with fewer years of informal discharge training may have been missing more components of the discharge process secondary to less experience. There was a missed opportunity to pair pre- and post-intervention results of each resident along with exploring the possibility of years of training effecting proficiency.

Table 3. Patient satisfaction scores before and after introduction of a standardized communication tool for discharge conversations.

Satisfaction scores	
Answer choices	Responses
Pre-intervention	
0 = not satisfied	2 (1%)
3 = somewhat satisfied	27 (13.5%)
5 = very satisfied	171 (85.5%)
Post-intervention	
0 = not satisfied	0 (9%)
3 = somewhat satisfied	4 (2%)
5 = very satisfied	196 (98%)
Fisher 2x3 table:	0.005

Differences between pre and post-intervention were analyzed with Fisher's 2 x 3 variant test.

P-values ≤0.05 were considered as statistically significant.

Table 4. Length of time spent by resident physicians during the discharge conversations with patients.

Pre-intervention (time in seconds)	162
Post-intervention (time in seconds)	244
Unpaired t-test	<0.001

Differences between pre and post-intervention were analyzed using the unpaired t-test.

P-values ≤ 0.5 were considered as statistically significant.

CONCLUSION

Formal education and the use of a standardized discharge mnemonic "DC HOME" improved emergency medicine resident physicians' performance at discharge. After implementation, patients perceived residents as more effective communicators at the time of discharge and expressed greater satisfaction with the discharge conversation.

Address for Correspondence: Michael T. Dalley, DO, Department of Emergency Medicine, 4300 Alton Road, Miami Beach, FL 33140. Email: michael.dalley@msmc.com.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Community Mural Tour: Facilitating Experiential Learning About Social Determinants of Health

Kamna S. Balhara, MD, MA*
Nathan Irvin MD, MSHPR*†

*Johns Hopkins University School of Medicine, Department of Emergency Medicine, Baltimore, Maryland

†Johns Hopkins Bloomberg School of Public Health, Center for Mental Health and Addiction Policy Research, Baltimore, Maryland

Section Editor: Danielle Hart, MD

Submission history: Submitted June 15, 2020; Revision received September 29, 2020; Accepted September 26, 2020

Electronically published November 20, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.9.48738

To successfully provide effective patient care within a healthcare system and broader society facing health inequities and social injustice, emergency medicine (EM) residents must demonstrate a nuanced understanding of social determinants of health (SDOH). Classroom or bedside instruction may be insufficient to generate meaningful engagement with patients' social contexts; experiential collaborative learning with community engagement has been suggested as an ideal modality for education about SDOH. We describe a low-cost, easily replicable activity involving observation and discussion of community murals within built environments. The tour was planned by EM faculty with expertise in graduate medical education, social EM, and the use of art in medical education. Prior to the activity, faculty selected murals situated in a variety of neighborhoods that would spark discussion on SDOH. Over the two-hour tour, residents stopped at city murals on a pre-planned route and engaged in observation and discussion. Faculty facilitators used established arts pedagogy, including visual thinking strategies and the concept of the "third thing," to facilitate a collaborative exploration of murals, surrounding communities, and larger implications for patients. The activity was successful in providing residents with a nuanced, context-specific approach to SDOH, sparking greater curiosity about the communities they serve, and engaging residents in reflection and conversation about personal preconceptions and how to better engage with surrounding communities. Since murals and street art are present and accessible in many different settings, residency programs could consider implementing a similar activity as part of their didactic curriculum. [West J Emerg Med. 2021;22(1)60-62.]

BACKGROUND

For emergency medicine (EM) trainees working within a healthcare system and broader society burdened by health inequity and social injustice, a nuanced understanding of social determinants of health (SDOH) is an essential competency.¹⁻³ EM trainees are often new to communities in which they work and may have vastly different lived experiences from their patients.⁴ Often caught between disparate realities, EM trainees must excel at anticipating patients' needs and understanding barriers patients face in order to provide effective and compassionate care, and they need training to do so. Traditional resident education focused largely on classroom- or hospital-based didactics may fail to generate a deeper, context-specific understanding of SDOH.

Experiential and collaborative learning, including community engagement, may lead to transformative learning in SDOH.⁵ Expanding beyond hospital walls into communities where patients live may represent an opportunity to better educate residents about SDOH.

We describe an "out-of-the-hospital" approach using city murals to address this gap in education. Art has been widely applied in medical education with impacts on observation skills, critical thinking, and empathy.^{6,7} Additionally, it can positively impact preconceptions toward patients and serve as a lens to examine biases.^{8,9} Much of art-based education, however, is museum-based, where art is often not representative of the diversity of surrounding communities.^{6, 10, 11} Conversely, murals are a form of social expression often designed by or in

conjunction with community members. Directly embedded into built environments, they evolve as neighborhoods change.¹² With these elements in mind, as part of a year-long social EM and humanities curriculum, we designed a tour of murals dispersed throughout the city to orient EM trainees to different neighborhoods and their social context.

OBJECTIVES

Upon tour completion, participants were expected to be able to do the following: 1) demonstrate improved understanding of patients' built environments and social contexts; 2) engage in reflection and discussion on SDOH impact on patients, with a focus on built environment; and 3) use visual thinking strategies to engage in close looking and perspective-sharing.

CURRICULAR DESIGN

We planned our tour using an online platform that maps murals in our program's city. A faculty member with expertise in social EM, a discipline that studies the interaction of social forces and health in EM, chose murals representative of the five categories of SDOH outlined in Healthy People 2020.¹³ Murals were selected both for content and inclusivity of neighborhoods. Background research on works' artists and relevance to the neighborhood was conducted. We developed a tour route using Google Maps.



Figure 1. Emergency medicine residents discussing a neighborhood mural.

The activity was advertised to all residents in our four-year program, although this was a smaller-scale pilot due to space constraints. Residents registered on a first-come, first-serve basis. Three EM faculty with expertise in medical education, art-based education, and social EM jointly facilitated the session for five participants. Observation and discussion of murals was mediated by faculty using visual thinking strategies (VTS) and the “third things” concept. Visual thinking strategies comprise a widely used pedagogical framework that fosters critical thinking, empathy, intellectual curiosity, and openness to the unfamiliar.¹⁴ In medical education, VTS enhances team cohesion, analytical skills, and communication.¹⁵

The tour also framed murals as “third things,” which are reflective triggers or conversational mediators that create safe spaces for perspective-sharing.¹⁶⁻¹⁸ Using these two techniques, learners collaboratively made meaning from what they saw. At each mural, learners disembarked from the van to participate in a facilitated discussion about the work and to reflect on the surrounding built environment (Figure 1). This cycle was repeated over two hours. Further reflection occurred while in transit between sites, and debriefing was conducted as participants were driven back to the hospital.

IMPACT/EFFECTIVENESS

The tour's impact was assessed via the richness of discussions during the activity, based upon faculty's notes on common discussion themes. Participants' insights were expansive, including observations on the presence of blight and vacancies, varied community assets including religious institutions, and local history as it related to either the community or the murals. Participants exhibited intellectual curiosity about communities visited and a more nuanced understanding of the built environment and role of SDOH in health. As “third things,” murals led participants to share differing perspectives and explore their own biases. Participants concluded by generating their own ideas about meaningful ways they could interact with the community.

Participants completed anonymous, electronic survey-based evaluations and universally rated the experience favorably (4/4 on a Likert scale). Participants' free-text responses reflected a universal appreciation for the opportunity to both view murals, which they found enlightening, and to experience communities that were new to them. One learner commented they subsequently felt inspired to be more involved in community engagement efforts. Participants reported that the tour generated a desire to learn more about the communities visited. Creating a learning environment where traditional hierarchies were leveled permitted a safe and open discussion among learners from different levels. In response to participants' feedback, future sessions will include additional neighborhoods and more historical context in partnership with local communities and artists.

Our evaluation was limited by a small number of volunteer participants susceptible to selection bias, and was

not designed to capture downstream impacts on knowledge and behavior. However, we believe the tour was an important step toward contextualizing the interplay between social factors and health. Mural tours are a low-cost, replicable approach to experiential and collaborative exposure to SDOH, and represent an opportunity for faculty to expand pedagogic partnerships beyond hospital walls to include local health officials, community members, and artists. Murals can spark context-specific discussion of social issues faced by patients, along with exposure to patient realities that are often invisible in clinical settings. While future studies are needed to evaluate downstream impacts on transfer of residents' SDOH knowledge to clinical care, this creative approach takes residents outside hospital walls and comfort zones. Such experiences can be invaluable as we move to meet the urgent need to heal some of the deep wounds that exist in our society and institutions.

Address for Correspondence: Kamna S. Balhara, MD, MA, Johns Hopkins University School of Medicine, Department of Emergency Medicine, 1830 E Monument St, Suite 6-100, Baltimore, MD 21287. Email: kbalhar1@jhmi.edu.

Conflicts of Interest: By the *WestJEM* article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Establishment of an Undergraduate FOAM Initiative: International Emergency Medicine (iEM) Education Project for Medical Students

Elif D. Cakal, MD*

Arif A. Cevik, MD†

Lit S. Quek, MD‡

Abdel Nouredin, MD§¶

Fikri Abu-Zidan, MD, PhD||

*University of Dundee, School of Medicine, Centre for Medical Education, Dundee, United Kingdom

†United Arab Emirates University, College of Medicine and Health Sciences, Department of Internal Medicine, Al Ain, United Arab Emirates

‡National University of Singapore, School of Medicine, Department of Emergency Medicine, Singapore

§Tawam Hospital, Department of Emergency Medicine, Al Ain, United Arab Emirates

¶Pinckneyville Community Hospital, Department of Emergency Medicine, Pinckneyville, Illinois

||United Arab Emirates University, College of Medicine and Health Sciences, Department of Surgery, Al Ain, United Arab Emirates

Section Editor: Ed Ullman, MD

Submission history: Submitted May 22, 2020; Revision received September 16, 2020; Accepted October 16, 2020

Electronically published December 16, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48385

Introduction: Our goal was to describe the structure, process, platforms, and piloting period activities of the International Emergency Medicine (iEM) Education Project, which is a Free Open Access Medical Education (FOAM) initiative designed for medical students.

Methods: This was a descriptive study. We analyzed the activity data of iEM Education Project platforms (website and image, video, audio archives) in the piloting period (June 1, 2018–August 31, 2018). Studied variables included the total and monthly views, views by country and continents, the official languages of the countries where platforms were played, and their income levels.

Results: Platforms were viewed or played 38,517 times by users from 123 countries. The total views and plays were 8,185, 11,896, and 18,436 in June, July, and August, respectively. We observed a monthly increasing trend in all platforms. Image archive and website were viewed the most. All platforms were dominantly viewed from Asia and North America, high- and upper-middle-income countries, and non-English speaking countries. However, there were no statistically significant differences between continents, income levels, or language in platforms, except for the website, the project's main hub, which showed a strong trend for difference between income levels (Kruskal-Wallis, $P = 0.05$). Website views were higher in high-income countries compared with low- and lower-middle income countries (Mann Whitney U test, $P = 0.038$ and $P = 0.021$, respectively).

Conclusion: The iEM Education Project was successfully established. Our encouraging initial results support the international expansion and increased collaboration of this project. Despite targeting developing countries with limited resources in this project, their engagement was suboptimal. Solutions to reach medical students in these countries should be investigated. [West J Emerg Med. 2021;22(1)63-70.]

INTRODUCTION

Methods of learning medicine have changed dramatically over the last decade. Web-based learning has revolutionized medical education by allowing information to be shared rapidly without borders, supporting individual needs.^{1,2} Advancements in web technology encourage physicians to participate globally and benefit from collective intelligence.³ After the term “Free Open Access Medical Education (FOAM)” was established, online medical learning gained fresh momentum, and a vibrant digital community was born.⁴ Finally, through social media, interactions within this global community reached its peak.⁵ The Emergency Medicine and Critical Care (EMCC) community, in particular, has been the leader of the FOAM movement.⁶⁻⁸

The FOAM resources targeting undergraduate medical education is lagging behind those targeting postgraduate education.^{9,10} This lag may be attributed to the topics favored by FOAM.¹⁰ Research and technical aspects, which appeal more to postgraduate students, are over-represented compared with core concepts that are of interest to medical students.⁹ ¹⁰ Increasing FOAM resources covering fundamental concepts may encourage medical students to engage with FOAM. FOAM is a valuable learning tool in undergraduate medical education that fits modern educational methods and instructional strategy.¹¹ It serves as a complement or an alternative to the traditional instructional techniques.¹²⁻¹⁴ Medical students appreciate FOAM because of its effectiveness, time-efficiency, convenience, and fun.^{12, 13, 15} ¹⁶ It can also save money and instructor time, compared with traditional techniques.¹¹

FOAM may also benefit undergraduate training in low- and middle-income countries (LMICs). In LMICs, staffing emergency departments (ED) is so big a challenge that medical graduates without further residency training work as independent physicians in EDs in some settings.¹⁷ To overcome this challenge, more healthcare staff must be trained; however, the scarcity of medical professionals hinders the education of future generations, thereby causing a vicious cycle.¹⁸ Educating local physicians in collaboration with the international emergency medicine (EM) community was suggested as a potential solution to break this cycle.¹⁹ Electronic learning, particularly FOAM can facilitate international collaboration by removing geographical boundaries, and reduce the dependence on local educators by giving access to otherwise expensive information, saving trainers’ time for hands-on training, and making information available at the point of care.^{11, 19-22}

The International Emergency Medicine (iEM) Education Project is a new international undergraduate FOAM initiative, which is aligned with the international undergraduate EM curricula recommendations.^{23,24} This project aims to promote and support undergraduate EM training internationally, especially in LMICs, and provide free learning resources for medical students and educators. It has five platforms: a

website as the main hub;²⁵ image archive;²⁶ video archive;²⁷ audio archive;²⁸ and social media. We aim to describe the structure, process, and piloting period activities of the iEM Education Project.

METHODS

Ethical Considerations

According to the United Arab Emirates University (UAEU) Research and Graduate Studies Ethics Guidelines, this study did not require an ethical approval process (an exemption) because it did not include human subjects and identifiers.

Structure and Process of the Project

Upon acknowledging the need for EM resources for medical students, three academic scholars (AAC, LSQ, AN) decided to create an electronic textbook for international medical students and interns at the end of 2014, laying the foundations of the iEM Education Project (Figure 1). English was chosen as the language of the project because it is the most prevalent language in the world.²⁹ One hundred six chapter titles were determined in alignment with the International Federation for Emergency Medicine (IFEM) and Society for Academic Emergency Medicine undergraduate curricula recommendations.^{23,24} Chapters’ internal structure was aligned with the natural flow of patient-physician interaction and mainly focused on the critical actions of the EM. To find authors, an email containing the selected chapter titles and asking for volunteers’ interest areas were distributed through the email groups of the IFEM, American College of Emergency Physicians International (ACEP-Int), and Council of Emergency Medicine Residency Directors (CORD-EM) in the first quarter of 2015. Answering the call were 133 contributors from 19 countries. In mid-2015, the chapters were assigned to the contributors according to their preference when possible, and most chapters were gathered until mid-2017. From the last quarter of 2017 to the middle of 2018, chapters written by contributors were reviewed by four editors in terms of content and format. Additionally, chapters were reviewed by a native English-language editor. Such generous support encouraged the founders to expand the project. After six months of online training and the development of infrastructure, a website including book chapters and blog, clinical and radiological image archive, video archive, audio archive, and social media accounts were initiated in May 2018.²⁵ The iEM Education Project was first officially announced at the IFEM’s International Conference on Emergency Medicine in Mexico City, Mexico, in June 2018, and its platforms were advertised regularly through social media.

The book chapters and blogposts were shared via a website placed in WordPress (Automattic Inc., San Francisco, CA), an open-source content management system.³⁰ The images were placed in the photo management and sharing application, Flickr (Mountain View, CA).³¹ Videos that

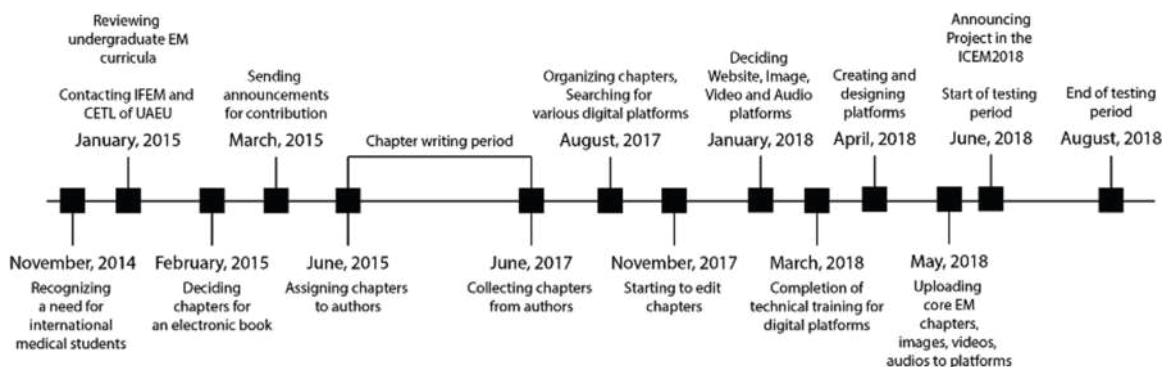


Figure 1. Timeline for constructing the International Emergency Medicine Education Project.

EM, emergency medicine; *IFEM*, International Federation for Emergency Medicine; *CETL*, Center for Excellence in Teaching and Learning; *UAEU*, United Arab Emirates University; *ICEM*, International Conference on Emergency Medicine.

are used in blogposts and book chapters were placed on YouTube (San Bruno, CA), a free video-sharing platform.³² Book chapters were voiced over digitally by the Amazon Polly application³³ and placed in the open audio platform, SoundCloud (Berlin, Germany).³⁴ All iEM Education Project contents were published with the project logo, content providers' names, and were licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 international license.³⁵

Creating such a project required considerable support from various stakeholders. In addition to IFEM, which endorsed the project from the beginning, several international EM associations, including ACEP-Int and CORD-EM supported and promoted the project during the preparatory phase and piloting period. Through associations' networks, we were able to gain support from the international EM community and recruit authors. UAEU supported the project financially. To keep expenses low, editors avoided professional services and processed most technical tasks themselves, including editing chapters, creating and designing platforms, creating and editing visual, audio and video files, and uploading all materials to relevant platforms. One of the editors received a total of approximately 22 hours of online training on electronic learning, WordPress, and search engine optimization. Additionally, depending on the length and content of the chapter, each chapter necessitated 10-20 hours of editors' work. The initial expenses were around 1,500 United States dollars, including costs of website hosting services, plugins, graphic design platforms, and applications.

Studied Variables

This is a descriptive study. We analyzed the data of the piloting period. During this piloting period, we aimed to explore the usage of project platforms and included three months from the announcement date (from June 1, 2018–August 31, 2018). During this period, the project had five active channels, namely, website, image, video, audio

archives, and social media. WordPress, Flickr, YouTube, SoundCloud, and Twitter (San Francisco, CA) were the hosting platforms of these channels, respectively. Each hosting platform provides anonymous activity data to the administrator. Only data from the hosting platforms were used in the analysis. We did not include social media activity in the analysis. Studied variables included the total and monthly views, views by country and continents, the official language of the countries, and their income level according to World Bank data for 2018 (low, lower-middle, upper-middle, high).

Statistical Analysis

We extracted available anonymous data to Microsoft Excel sheets (Microsoft Corporation, Redmond, WA). The data was coded and cleaned for statistical analysis. The Shapiro-Wilk test was used for normal distribution analysis of the data. We used non-parametric tests because the distribution of the data was not normal. Categorical data are presented as frequency (%), and continuous variables are presented as median (range), where appropriate. Continuous variables were assessed with the Mann-Whitney U test (for two independent groups) and Kruskal-Wallis test (for more than two independent groups). The significance level was determined at 0.05. Statistical analyses were performed using the Statistical Package for the Social Sciences version 26 (IBM Corp, Armonk, NY).

RESULTS

In total, the iEM Education Project platforms were viewed or played 38,517 times by users from 123 countries. The total views and plays were 8,185, 11,896, 18,436 in June, July, and August, respectively (Table 1).

Website

The website is the main hub of the project. At the end of the piloting period, 85 chapters and 126 blogposts were published on the website and viewed a total of 13,778 times by users from 117 countries. The number of views was 2,484,

Table 1. Views and plays according to platform.

Platform	Content	Views and plays N (%)				Number of countries
		June	July	August	Total	
Website	85 chapters and 126 blogposts	2,484 (30.4)	4,444 (37.4)	6,850 (37.2)	13,778 (35.8)	117
Image archive	674 visuals	5,391 (65.9)	7,035 (59.1)	10,703 (58.1)	23,129 (60.1)	N/A
Video archive	107 videos	237 (2.9)	290 (2.4)	649 (3.5)	1176 (3.1)	60
Audio archive	41 audio chapters	73 (0.9)	127 (1.1)	234 (1.3)	434 (1.1)	41
Total	1,033	8,185	1,1896	18,436	38,517	123*

*After excluding overlapping countries

N/A: Data was not available.

Table 2. The website views according to continents, income levels and language.

	Countries N (%)	Views N (%)			Total views N (%)	P-value
		June	July	August		
	117 (100)	2,484 (100)	4,444 (100)	6,850 (100)	13,778 (100)	
Continents						0.244
Africa	15 (12.8)	4 (0.2)	176 (3.9)	53 (0.8)	233 (1.7)	
Asia	37 (31.6)	1,391 (55.9)	2,204 (49.6)	1,855 (27.1)	5,450 (39.6)	
Europe	38 (32.5)	239 (9.6)	836 (18.8)	759 (11.1)	1,834 (13.3)	
North America	13 (11.1)	690 (27.8)	993 (22.3)	3,453 (50.4)	5,136 (37.3)	
Oceania/Australia	3 (2.6)	33 (1.3)	51 (1.1)	77 (1.1)	161 (1.2)	
South America	11 (9.4)	127 (5.1)	184 (4.1)	653 (9.5)	964 (6.9)	
Income level						0.05
Low	6 (5.2)	2 (0.08)	49 (1.1)	2 (0.03)	53 (0.4)	
Lower-middle	24 (20.5)	138 (5.6)	205 (4.6)	371 (5.4)	714 (5.2)	
Upper-middle	33 (28.2)	1,149 (46.3)	2,293 (51.6)	3,688 (53.8)	7,130 (51.7)	
High	54 (46.1)	1,195 (48.1)	1,897 (42.7)	2,789 (40.7)	5,881 (42.7)	
Language						0.865
English	28 (23.9)	598 (24.1)	1,113 (25.1)	1880 (27.4)	3,591 (26.0)	
Non-English	89 (76.1)	1,886 (75.9)	3,331 (74.9)	4,970 (72.6)	10,187 (74.0)	

4,444, and 6,850 in June, July, and August, respectively. Of those views, 76.9% were from Asia and North America and 94.4% of views were from high- and upper-middle-income countries, while 5.6% were from LMICs. Views from countries of which the official language was not English constituted 74% of the total. The views according to continents, income levels, and languages are given in Table 2. There was no difference in views between continents (Kruskal-Wallis, $P = 0.244$), and language (Mann Whitney U test, $P = 0.865$). There was a strong trend for difference

between income levels by views (Kruskal-Wallis, $P = 0.05$), the views were higher in high-income countries compared with low- and lower-middle-income countries (Mann Whitney U test, $P = 0.038$ and $P = 0.021$, respectively) (Figure 2).

Image Archive

Until the end of the piloting period, 674 visuals were published on Flickr image archive and viewed a total of 23,129 times. The number of views was 5391, 7035, and 10,703 in June, July, and August, respectively.

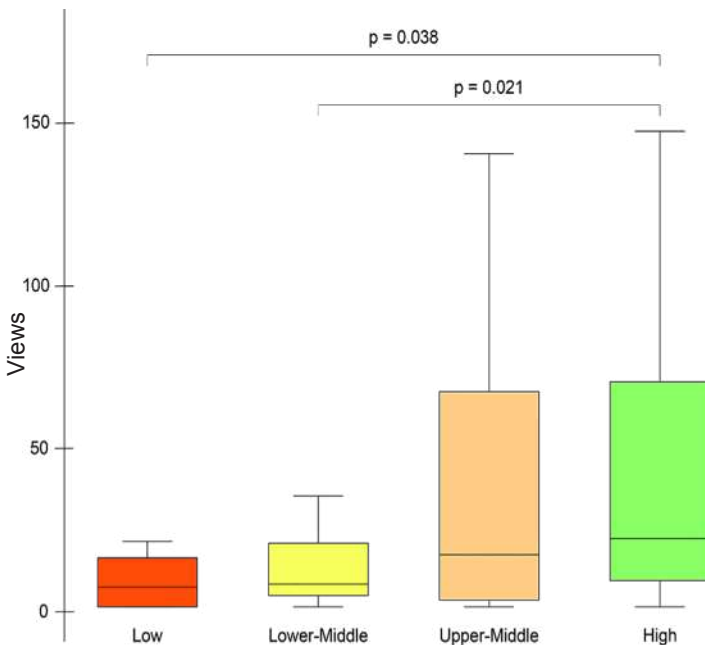


Figure 2. Box-and-whiskers comparison plot of website views by income levels.

Each box shows the Interquartile range (from the 25th-75th percentile). The horizontal line within each box represents the median. P-values by Kruskal-Wallis tests. Outliers have been removed from the figure.

Video Archive

Until the end of the piloting period, 107 videos were published on YouTube video archive and viewed a total of 1,176 times by users in 60 countries. The number of views was 237, 290, and 649 in June, July, and August, respectively. Asia (54.3%), North America (29.2%), and Europe (9.2%) were the top three continents where the video content was viewed. High- and upper-middle-income countries constituted 90.2% of the views. Non-English-speaking countries accounted for 74.7% of the views. There were no differences in views by continents (Kruskal-Wallis, $P = 0.350$), income levels (Kruskal-Wallis, $P = 0.627$), and language (Mann-Whitney U test, $P = 0.840$).

Audio Archive

Until the end of the piloting period, 41 audio chapters were published on SoundCloud audio archive and played a total of 434 times by users in 41 countries. The number of views was 73, 127, and 234 in June, July, and August, respectively. Asia (39.2%) and North America (32.5%), and Europe (13.4%) were the top three continents where users played the audio content. High- and upper-middle-income countries constituted 91.7% of the plays. Non-English-speaking countries accounted for 61.9% of the plays. There were no differences in plays by continents (Kruskal-Wallis, $P = 0.349$), income levels (Kruskal-Wallis, $P = 0.309$), and language (Mann-Whitney U test, $P = 0.508$).

DISCUSSION

In this study, we analyzed the piloting period data of the iEM Education Project, an EM FOAM project devoted to undergraduate EM training. The platforms were ranked in decreasing order of views as Flickr image archive, website, YouTube video archive, and SoundCloud audio archive. The monthly increase in views and plays in the piloting period encouraged us to continue publishing and expanding the project. The majority of views and plays were from high and upper-middle-income countries. Although all channels were in English, countries where English is not the official language used the source more often.

Little has been published about the activity data of FOAM projects, much less regarding their early periods. Acilci.net, a FOAM blog in Turkish, was reported to have been visited 3,500 times in its first month.³⁶ St.Emlyn's blog grew from 3497 to 36,377 average monthly views between 2012–2016.³⁷ Other reports from the Academic Life in Emergency Medicine blog examined the activity and impact of FOAM for specific topics such as resident well-being, team-based learning, and resident teachers.^{38–40} All three reports demonstrated the potential of FOAM to be an asynchronous learning tool and “global classroom.” The iEM Education Project book chapters and blog were viewed over 13,500 times in the piloting period. All platforms included, over 38,500 views and plays from 123 countries were recorded. Among them, website and image archive were viewed the most. While the different amounts of content in each platform make the comparison of usage difficult, the relatively high traffic on website and image archive made us put more effort into these platforms. Overall, the monthly increase in the use of all platforms encouraged us to continue to project with all of them.

The EMCC community has shown a growing interest in FOAM from the start, but EMCC resources designed for medical students remain limited so far.^{4,7} Over 180 websites that publish EMCC-related topics in English existed in 2013.⁷ Despite this considerable number, EMCC FOAM resources were mostly directed at postgraduate training, probably too advanced for undergraduate training and unable to cover the entire core topics.^{9,10,41} Few websites explicitly focus on core concepts that medical students need.^{9,42–44} The iEM Education Project is among the few FOAM resources that focuses on undergraduate EM training and follows international undergraduate curricula recommendations.

The majority of medical students seem to use online resources.^{45–47} In terms of the frequency of use or perceived usefulness, online resources ranked in the top three by medical students.^{47–51} Notably, Al-Hazmi reported that medical students used online resources more than textbooks.⁴⁹ Despite the popularity of online resources among medical students, resources devoted to medical students remain limited. The considerable and increasing amount of activity in the piloting period indicates that the iEM Education Project contributed as a useful online resource for medical students.

Despite the widespread use of clinical images in undergraduate medical education, sourcing clinical images poses challenges both to medical students and educators. Medical images facilitate learning both core and complex concepts and improve memory.⁵² A recent survey demonstrated that 87% of medical students use clinical images.⁵³ The Internet was the primary source (96%), and approximately one-third of medical students found it difficult to find appropriate images. The cost, validity, consent level, file size, and copyright status were important factors affecting students' choice for using clinical images.⁵³ Medical educators sourced medical images mainly from open-access search engines, social media, and student textbooks. Nevertheless, they were worried about copyright violation and consent level.⁵² In this regard, iEM Education Project Image Archive seems to address medical students' and educators' concerns by providing cost- and copyright-free medical images. This may explain why it is the most viewed iEM Education Project platform.

iEM Education Project platforms were accessed from five continents. In total, most views were from Asia and North America. Although views in the third month increased in all continents compared to their views in the first month, views from North America and South America showed a more prominent and regular increase. Various factors that might be affecting this distribution were suggested in the literature.⁶ Language seems to be one of the determinants.⁶ No previous study has extensively examined how language impacts access to FOAM, but few studies present controversial results. Overall, FOAM users are concentrated in English-speaking countries.⁶ However, 74% of views of the iEM Education Project website were from countries where English is not the official language. Interestingly, a FOAM blog publishing in Turkish reported that 10.6% of views were from 111 different countries, possibly doctors from Turkic origins.³⁶ Similarly, the geographically dispersed access to iEM platforms may be attributed to the users who speak English as a primary or secondary language; however, built-in automatic translation placed on our website may also have facilitated the use of the website for users with little or no English proficiency.³⁶ Our findings may imply that FOAM platforms in English seem to have considerable international reach, but how publishing in other prevalent or multiple languages might affect the international reach and the distribution of views remains to be discovered in future studies.

Another determinant of view distribution may be economics.⁶ A previous study, which reviewed approximately 18.7 million views of 12 FOAM blogs, found that views from high-income countries constituted approximately three-quarters of the total.⁶ Similarly, the iEM Education Project platforms were used dominantly from high-income and upper-middle-income countries. Even if the views from LMICs increased slightly each month, they constituted less than 6% of total views. Online learning was heralded as a feasible solution to challenges of medical education in resource-limited contexts, but in actuality the dissemination of FOAM remains limited in

LMICs.⁵⁴⁻⁵⁷ The previous reports demonstrated that the impact of FOAM on LMICs was below expectations for several reasons. Infrastructure-related problems – such as limited access to computers and the Internet, and slow Internet speed; system-related problems such as the lack of systemic, curriculum-based approach; and general lack of awareness of FOAM, information and communications technology skills – hinder FOAM's dissemination in LMICs.⁵⁴⁻⁵⁷ The low engagement from LMICs with the iEM Education Project may be a reflection of the constraints mentioned above and our marketing strategy.⁶ We advertised our project through international associations' email groups and social media, in which the representation of LMICs might be less than ideal. Targeting more local EM organizations in LMICs could promote the project in areas in need more effectively. Nevertheless, more studies are needed to discover factors affecting the usage of online resources from different countries and regions.

LIMITATIONS

We have to acknowledge that there are several limitations to this study. One major limitation is that although we targeted medical students and advertised our project accordingly, we could not confirm whether all viewers were medical students as targeted. At the start of the project, we refrained from requiring any kind of registration as it could have caused privacy concerns and discouraged users from using our platforms.⁵⁸ Alternatives to registration include single sign-on. However, even these techniques do not guarantee that the provided personal information is correct.⁵⁸ Our initial evaluation included a short period of time. Although an extended period could have revealed more information and strengthened the statistical analysis, we intentionally examined the activity data from the piloting period to address potential issues early. We have used data provided by hosting services, which we did not have control over. Furthermore, the lack of data about some platforms (eg, Flickr) limited our analysis. Using additional services (eg, Google Analytics) may have increased the types of data available. Finally, during the piloting period, the major means for promotion was through social media. The editors' social network may have affected the countries that use iEM Education Project resources in the piloting period.

CONCLUSION

The International Emergency Medicine (iEM) Education Project, a free open-access medical education resource devoted to medical students, was successfully established. Our encouraging initial results support the international expansion of and increased collaboration on this project. Despite targeting developing countries with limited resources, we found that their engagement was suboptimal. Solutions to reach medical students in these countries should be investigated more. We hope that reporting our experience and data may inspire educators to create more undergraduate FOAM resources and prepare them for upcoming challenges.

Address for Correspondence: Arif Alper Cevik, MD, United Arab Emirates University, College of Medicine and Health Sciences, Department of Internal Medicine, Emergency Medicine Section, Al Ain, United Arab Emirates, 17666. Email: aacevik@uaeu.ac.ae.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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There's an App for That: A Mobile Procedure Logging Application Using Quick Response Codes

Jason Folt, MD*
Patrick Lam, MD†
Joseph Miller, MD, MS*†
Nikhil Goyal, MD*†

*Henry Ford Health System, Department of Emergency Medicine, Detroit, Michigan
†Henry Ford Health System, Department of Internal Medicine, Detroit, Michigan
‡CaroMont Regional Medical Center, Department of Emergency Medicine, Gastonia, North Carolina

Section Editor: Jeffrey Love, MD

Submission history: Submitted June 15, 2020; Revision received October 12, 2020; Accepted October 19, 2020

Electronically published December 10, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48724

Emergency medicine residents are required to accurately log all procedures, yet it is estimated that many procedures are not logged. Traditional procedure logging platforms are often cumbersome and may contribute to procedures not being logged or being logged inaccurately. We designed a mobile procedure logging application (app) that uses quick response (QR) codes to input patient information quickly and accurately. The app integrates with our current procedure log database while maintaining information privacy standards. It scans the QR code displayed for patient identification, automatically extracting pertinent patient information. The user selects the procedure performed and the app uses data analytics to recommend logging other related procedures.

A mobile procedure logging app using QR codes decreases time needed to log procedures and eliminates data entry errors. Improving the speed and convenience of procedure logging may decrease the discrepancy between performed and logged procedures. A similar app can be integrated into any residency program and may improve assessment of resident procedural competency. [West J Emerg Med. 2021;22(1)71-73.]

BACKGROUND

Maintaining a complete and accurate procedure log is a fundamental element of emergency medicine (EM) residencies. Such logs assist in the assessment of procedural competency and help identify areas of study during resident self-evaluation.¹ Additionally, the procedure log is an important Accreditation Council for Graduate Medical Education requirement for EM residencies, yet poor compliance with procedure logging requirements is one of the most frequent citations during accreditation reviews.²⁻⁴ It is estimated that only 37%-60% of performed procedures are eventually logged.^{5,6}

Our program's procedure-logging system ("Website") has a data entry webpage that interfaces with a secure database. It was developed in-house and resembles popular commercial platforms.^{7,8} It requires accessing a workstation, logging in, selecting a date and procedure, and then manually typing patient name, age, gender, medical record number (MRN), faculty supervisor, and rotation name. This can be

cumbersome during a busy work period and may contribute to low logging rates. Some residency programs have developed mobile device-based workflows to mitigate access issues, yet they still require manual data input that may lead to inaccurate logs due to data entry errors.⁹⁻¹³ Procedure logs are a key component of learner assessment in competency-based medical education; therefore, incomplete logging or erroneous patient information may have substantial implications for the resident, the residency program, and our patients.¹

OBJECTIVES

The study goal was to demonstrate feasibility of a mobile procedure logging application ("app") that uses quick response (QR) codes to automatically read patient data. The primary objective was to compare the speed and accuracy of the app to traditional processes. The secondary objective was to measure app adoption by comparing percentage of app-logged procedures during initial deployment to a similar period three years later.

DESIGN

A mobile app was created and deployed at a 50-resident EM program via a 10-minute introduction during didactics. Login information for each user is securely stored in the app to eliminate the need for repetitive logins. The app scans the QR code on each patient's identification sticker and automatically extracts the patient name, birthdate, MRN, and gender. When a user selects the procedure performed from a drop-down menu, the app then suggests other commonly associated procedures that the user may select if they were also performed. For example, the app may say: "Residents who logged I&D also logged ultrasound guidance or procedural sedation; please select the corresponding checkbox to log these." The procedure or procedures are then recorded in the procedure log database.

The study period was January 1, 2016–March 31, 2016, during which residents had the option to use the app or Website. The three-month period was chosen as consistent with the rapid application development method of software development.¹⁴ All procedures were logged by residents without additional assistance or direct observation. Every procedure log entry created during the study period was examined. Google Analytics measured the time taken on the app or Website to complete a log entry and then we calculated the mean time taken to log a procedure using each method. We then compared results for the app vs the Website. For the secondary objective, the proportion of total procedures logged via the app during the study period was compared to the proportion logged between January 1, 2019–March 31, 2019.

To identify data entry errors, procedure log patient information was compared to corresponding information in the electronic health record. When the last name, age or gender of the patient in the procedure log did not match the medical record, the data was flagged as an error. MRN errors could not be captured as it was not possible to link these to a unique medical record. Some of these unmatched MRNs may have been errors, but they also may have represented procedures performed at other hospitals while on outside rotations. We excluded these unmatched MRNs from analysis.

Institutional review board approval and informed consent were obtained. The app was developed by one of the authors using HTML, JavaScript, PHP, and MySQL over approximately 10 hours of time. A QR code reader library was purchased for \$1600 and the app was deployed on a basic intranet server. Source code for the app is freely available from the authors and may be easily modified to work with any residency's procedure log database. We used descriptive statistics to compare procedure logging using the app or Website, and chi-square analysis was used for categorical comparisons.

IMPACT/EFFECTIVENESS

A total of 2930 procedures were logged during the study period, of which 142 (4.8%) were logged using the app by 11 unique residents. On average, it took 27 seconds to log a

procedure using the app, compared to 80 seconds using the Website. Data entry errors were significantly decreased using the app compared to the Website (Table 1). All procedures logged by the app were accurate and without errors in patient information.

After three years, there was a fivefold (95% confidence interval 4.3x to 6.0x) increase in the proportion of procedures logged with the app to 841/3397 (24.8%; $P < 0.001$). There were 18 unique resident users during this time. A mobile application using QR codes proved feasible at quickly and accurately logging procedures. The mean time spent logging each procedure substantially decreased, suggesting the app was easier to use. QR codes have previously been used for various applications in healthcare education, but the timesaving and error reduction in procedure logging has not been reported.¹⁵ The recommendation algorithm for suggesting frequently co-logged procedures is also novel.

The app's low initial adoption rate increased significantly over time. This may be because of the hospital's information security requirement to install encryption software on personal phones. With education about privacy implications of this software, app usage increased without any mandate by the residency. Additionally, as senior residents who were comfortable with the Website graduated, incoming residents adopted the app more readily. There do remain other barriers to the app use: Some residents do not carry their phones on shift, limiting their ability to use the app. Additionally, residents rotate at sites outside of our hospital that do not use QR code technology for patient identification.

This study has several limitations. Because it was a feasibility study performed at a single center with a convenience sample, generalizability is therefore limited. Due to privacy concerns, Google Analytics does not allow for analysis of individual procedure logging sessions. We therefore could not calculate variability in the procedure logging time data to detect statistically significant differences. Additionally, the number of unsuccessful logging attempts by the app and the Website was not available. Finally, while we were not able to identify procedures that were performed but not logged, we believe improving the speed, feasibility, and convenience of procedure logging may decrease the discrepancy between performed and logged procedures.

Table 1. Comparison of data entry errors through a program's online procedure-logging system (Website) compared to a mobile procedure logging application.

Data field	Website errors (rate)	App errors	P-value
Patient last name	374 (15%)	0	<0.001
Patient age	237 (9%)	0	<0.001
Patient gender	60 (2%)	0	0.074

App, application.

In conclusion, this proof-of-concept shows that a mobile procedure logging application that reads patient information using quick response codes decreases the time to log a procedure and eliminates data entry errors. Compared to traditional procedure logging tools, the app may generate a more accurate record of resident procedural competence. While more rigorous studies are needed to verify these findings, we feel this technology is applicable to other residencies and specialties that require residents to maintain a procedure log.

Address for Correspondence: Jason Folt, MD, Henry Ford Health System, Department of Emergency Medicine, 2799 W Grand Blvd, CFP-259, Detroit, MI, 48202. Email: jfolt1@hfhs.org.

Conflicts of Interest: By the *WestJEM* article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Novel Approach to Neonatal Resuscitation Education for Senior Emergency Medicine Residents

Jennie A. Buchanan, MD*

Patricia Hagan, MD†

Taylor McCormick, MD*

Genie Roosevelt, MD, MSPH*

W. Gannon Sungar, DO*

Christy Angerhofer‡

Richard Byyny, MD, MSc

Maria Moreira, MD*

*Denver Health & Hospital Authority, University of Colorado, Department of Emergency Medicine, Denver, Colorado

†Denver Health & Hospital Authority, Department of Pediatrics, Denver, Colorado

‡Diversity, Equity, & Inclusion, University of Colorado School of Medicine, Aurora, Colorado

Section Editor: Chris Merritt, MD, MPH, MHPE

Submission history: Submitted June 9, 2020; Revision received September 14, 2020; Accepted October 19, 2020

Electronically published November 20, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48623

The majority of pediatric visits occur in general emergency departments. Caring for critically ill neonates is a low-frequency but high-stakes event for emergency physicians, which requires specialized knowledge and hands-on training. We describe a novel clinical rotation for emergency medicine (EM) residents that specifically augments skills in neonatal resuscitation through direct participation as a member of the neonatal resuscitation team. The neonatal resuscitation rotation evaluation median score of 4 (interquartile range [IQR] 3,4) was higher compared to all other off-service senior resident rotations combined (median 3, IQR 3,4) for the academic year 2018-2019. Ninety-two percent of residents evaluated the curriculum change as beneficial (median 4, IQR 4,4). The neonatal resuscitation rotation was rated more favorably than the pediatric intensive care rotation (median 4 IQR 3,4 vs median 3, IQR 2, 3) at a tertiary care children's hospital during the third year. Residency programs may want to consider implementing a directed neonatal resuscitation experience as part of a comprehensive pediatric curriculum for EM residents. [West J Emerg Med. 2021;22(1)74-76.]

BACKGROUND

Children account for ~25% of emergency department (ED) visits in the United States.¹ The vast majority of pediatric visits occur in community EDs, many of which see fewer than 15 children per day in hospitals and lack the resources, personnel, and experience to deliver comprehensive pediatric and neonatal critical care.¹⁻³ This reality highlights the importance of pediatric readiness for all EDs to stabilize pediatric patients and transfer them to a higher level of care if necessary. In 2009, the major emergency medicine (EM) and pediatric societies jointly published guidelines for pediatric readiness of all EDs, which include proficiency in neonatal resuscitation, stating: "It is essential that hospital ED staff and administrators and EMS systems' administrators and medical directors seek to meet or exceed these guidelines in efforts to optimize the emergency care of children they serve."⁴

Caring for critically ill children, and in particular neonates,

is a low-frequency and high-stakes scenario for emergency physicians. Pediatric case exposure during residency varies dramatically, and the impact on competence is unknown.⁵ Most EM training focuses on experience in pediatric intensive care units (PICU) and the resuscitations that occur in the ED. However, even EM residents who rotate through high-volume children's hospital EDs are exposed to very few critically ill patients and get little or no exposure to neonatal resuscitation, a fundamental competency for all emergency physicians to ensure pediatric readiness of all EDs regardless of pediatric volume or acuity.⁶ We describe a novel clinical rotation for advanced EM residents that specifically augments skills in neonatal resuscitation by direct participation as a member of the neonatal resuscitation team.

OBJECTIVES

Our educational objective was to design a rotation focused

specifically on neonatal resuscitations. During this novel rotation, 17 senior EM residents were embedded with the neonatal resuscitation team, attending emergent deliveries and resuscitations.

CURRICULAR DESIGN

The EM residency is a four-year program with 68 total residents based at an urban, safety-net hospital with adult Level I and pediatric Level II trauma center with a dedicated pediatric ED. The rotation is based at the sponsoring residency institution, an academic safety-net hospital accredited by the Accreditation Council for Graduate Medical Education. The hospital has a Level III nursery staffed by four neonatologists as well as a pediatric intensive care unit (PICU) with 10 beds staffed by four intensivists and an 18-bed inpatient pediatric ward. Senior EM residents receive Neonatal Resuscitation Program (NRP) certification through training specifically tailored for them from the pediatric ED nurse educator and a fellowship-trained pediatric EM attending prior to the rotation. During the weeklong rotation, the resident's primary responsibility is to participate in neonatal resuscitations with the neonatology team specifically focusing on the critically ill newborn in the first few minutes after birth.

The resuscitation team is composed of the EM resident, neonatal intensive care unit (NICU) advanced practice provider, and nurse (75% of deliveries). A respiratory therapist attends an additional 20% of deliveries if there are prenatal concerns for respiratory distress. For the most complex deliveries (eg, less than 23 weeks gestational age or congenital diaphragmatic hernia), a NICU attending and pharmacist attends. The EM resident is head of bed leading the resuscitation except for the most complex deliveries in which case they would help with assessments. The EM residents attend 3-5 neonatal resuscitations per day, and participate in 3-4 high-fidelity simulation scenarios per day. They also participate in obstetric, PICU and NICU rounds, and may assist with procedures in those units.

Residents are required to give a short presentation on a neonatal resuscitation topic during the week. At the end of the rotation, the residents are expected to set up a neonatal resuscitation, either simulated or in the delivery room, and lead the team through the resuscitation. Previously the senior residents had one week of administration and one week of medical malpractice case review, which were combined into a one-week rotation to allow for the neonatal resuscitation rotation. This research was granted exempt status by the local multiple institutional review boards.

IMPACT/EFFECTIVENESS

Annually, the EM residents evaluate rotations and changes to the curriculum on a four-point scale (1 = detrimental, 2 = somewhat detrimental, 3 = somewhat beneficial and 4 = beneficial). Evaluation scores are presented as medians with interquartile ranges (IQR). All 17 senior EM residents completed the annual survey. The neonatal resuscitation rotation evaluation median score of 4 (IQR 3,4) was higher compared to all other

off-service senior resident rotations combined (median 3, IQR 3, 4) for the academic year 2018-2019. Ninety-two percent of senior residents evaluated the curriculum change as beneficial (median 4, IQR 4,4). The neonatal resuscitation rotation was evaluated as more beneficial (median 4, IQR 3,4) as compared to the PICU rotation (median 3, IQR 2, 3) at a tertiary care children's hospital during the residents' third year.

We believe the success of this rotation was due to several factors. The nurse educator for the pediatric ED is a NRP instructor and was willing to provide tailored education to the senior residents along with a pediatric EM attending. The ED and residency program have an excellent relationship with the inpatient pediatric department. The neonatologists and intensivists had previously partnered with us to teach our EM residents during pediatric critical care boot camps. Therefore, the neonatologists had been exposed to the EM residents and had a favorable impression of them prior to the initiation of the rotation.

The neonatologists were very receptive to developing a new rotation specifically addressing the needs of the EM residency program focusing on newborn resuscitation rather than continued care of premature infants in the NICU. Fortunately, there were minimal competing learners for this experience in contrast to many tertiary care NICU and PICU rotations. We believe these factors emphasize the importance of situated cognition in medical education in which learners are more likely to learn when the education provided is within the learners' practice domain. The needs of the EM residents were recognized as different than the needs of pediatric or neonatology trainees. We have added additional simulation scenarios for the residents to solidify their neonatal resuscitation knowledge throughout their senior year. A limitation of our study is that our primary outcome measure was a subjective satisfaction score.

It is imperative that emergency physicians be competent in pediatric and neonatal resuscitation given that over 90% of pediatric emergency visits will occur in community EDs.³ Given the lack of exposure to critically ill pediatric patients in EM training, EM programs need to consider innovative alternatives to provide their residents with a strong foundation for all ages of pediatric resuscitation.

Address for Correspondence: Jennie A. Buchanan, MD, Denver Health & Hospital Authority, Department of Emergency Medicine, 601 Bannock Street, Mail Code 0108, Denver, CO 80204. Email: jennie.buchanan3@dhha.org.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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More Is More: Drivers of the Increase in Emergency Medicine Residency Applications

Robert D. Huang, MD*
 Lucienne Lutfy-Clayton, MD†
 Douglas Franzen, MD, Med‡
 Alexis Pelletier-Bui, MD§
 David C. Gordon, MD¶
 Zachary Jarou, MD*||
 Jim Cranford, PhD*
 Laura R. Hopson, MD*

*University of Michigan, Department of Emergency Medicine, Ann Arbor, Michigan
 †University of Massachusetts Medical School – Baystate Health, Department of Emergency Medicine, Springfield, Massachusetts
 ‡University of Washington School of Medicine, Department of Emergency Medicine, Seattle, Washington
 §Cooper Medical School of Rowan University, Department of Emergency Medicine, Camden, New Jersey
 ¶Duke University, Department of Emergency Medicine, Durham, North Carolina
 ||St. Joseph Mercy Ann Arbor, Department of Emergency Medicine, Ypsilanti, Michigan

Section Editor: Danielle Hart, MD, MACM

Submission history: Submitted May 14, 2020; Revision received October 19, 2020; October 24, 2020

Electronically published December 10, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48210

Introduction: The average number of applications per allopathic applicant to emergency medicine (EM) residency programs in the United States (US) has increased significantly since 2014. This increase in applications has caused a significant burden on both programs and applicants. Our goal in this study was to investigate the drivers of this application increase so as to inform strategies to mitigate the surge.

Methods: An expert panel designed an anonymous, web-based survey, which was distributed to US allopathic senior applicants in the 2017-2018 EM match cycle via the Council of Residency Directors in Emergency Medicine and the Emergency Medicine Residents Association listservs for completion between the rank list certification deadline and release of match results. The survey collected descriptive statistics and factors affecting application decisions.

Results: A total of 532 of 1748 (30.4%) US allopathic seniors responded to the survey. Of these respondents, 47.3% felt they had applied to too many programs, 11.8% felt they had applied to too few, and 57.7% felt that their perception of their own competitiveness increased their number of applications. Application behavior of peers going into EM was identified as the largest external factor driving an increase in applications (61.1%), followed by US Medical Licensing Exam scores (46.9%) – the latter was most pronounced in applicants who self-perceived as “less competitive.” The most significant limiter of application numbers was the cost of using the Electronic Residency Application Service (34.3%).

Conclusion: A substantial group of EM applicants identified that they were over-applying to residencies. The largest driver of this process was individual applicant response to the behavior of their peers who were also going into EM. Understanding these motivations may help inform solutions to overapplication. [West J Emerg Med. 2021;22(1)77-85.]

INTRODUCTION

In 2018 emergency medicine (EM) was the third most commonly matched specialty, comprising 7.5% of graduating

allopathic seniors in the United States (US).¹ A total of 1,748 US allopathic seniors ranked EM as their top specialty in the 2018 match with a mean contiguous ranking of 12.8

programs among matched applicants.¹ In comparison to applicants from the 2016 match with regard to United States Medical Licensing Examination (USMLE) scores, experiences (research, volunteer, work), Alpha Omega Alpha Honor Medical Society (AOA) status, and additional degree, the 2018 applicants were similar.²

Despite similarities in applicant characteristics, in just a two-year period the average number of US allopathic applications rose from 93,456 in 2016 to 111,964 in 2018, despite an increase of only 233 applicants.³ A greater number of applications requires a concurrent increase in time and effort by programs to review applicants and make decisions about interview selection.⁴ When coupled with the lack of robust outcomes data on which aspects of an applicant's portfolio predict future residency success, program directors and coordinators must spend substantial resources attempting to analyze these applications in order to find those who may be a "best fit" for their program. Additionally, the increase in applications to EM residency puts additional financial strains on the applicants themselves.⁵ Students incur substantial financial costs from an increase in the number of residency applications and interviews on top of potentially substantial medical school debt. This occurs on top of the already expensive EM application process that values electronic Standardized Letters of Evaluation (eSLOE) from away rotations.⁶

Our objective in this study was to investigate the drivers of the increase in EM resident applications so as to inform potential strategies to mitigate the surge.

METHODS

We created an anonymous, web-based survey for distribution to US allopathic senior applicants in the 2017-2018 EM match cycle. The author group represented a multi-institutional expert panel composed of academic EM faculty with both program and clerkship director experience to provide content validity. All survey designers had extensive experience with the match and application processes, represented diverse program formats and geographic regions, and had experience and expertise in survey design and survey-based research. We iteratively designed and refined the survey, which was piloted on a small group of first-year EM residents to obtain feedback on content and structure. This survey was disseminated using a survey-building tool (Qualtrics XM, Provo, UT) and was administered anonymously after the National Residency Match Program (NRMP) rank list certification deadline and prior to the release of match results in order to minimize response bias or a feeling of influence from the survey authors. The study was distributed via both the Council of Residency Directors in Emergency Medicine (CORD-EM) and the Emergency Medicine Residents' Association (EMRA) listservs, as well as advertised on Twitter and the /r/medschool subreddit. To encourage participation, participants could elect to provide their email

Population Health Research Capsule

What do we already know about this issue?
While the number of individual applicants to emergency medicine (EM) increased by only 233 from 2016 to 2018, the number of overall applications increased by 18,508.

What was the research question?
What is driving the increase in EM resident applications?

What was the major finding of the study?
Individual applicant's behavior was substantially motivated by the behavior of their peers going into EM.

How does this improve population health?
This project may inform future interventions by the EM community to create meaningful change in application behaviors.

address on a separate unlinked survey for a gift card drawing. The study was given exempt status by the institutional review board of the lead author's home institution.

In addition to demographic information, respondents were asked to give their perspective on multiple factors potentially influencing their application behavior, as outlined in Tables 2-4. The survey also asked for information on the number of programs applied to and factors influencing their decision. Additionally, respondents were asked to give their perspective on how multiple factors influenced the number of EM programs they applied to. Applicants were also asked to retrospectively evaluate whether they thought they had applied to too many, too few, or the right amount of EM programs.

The respondents were also broken into subgroups based on their self-assessment of competitiveness to evaluate for differentiation in trends among applicants who identified as "very competitive," "competitive," and "less competitive" for EM residency. In addition to descriptive statistics, associations between self-perceived competitiveness were tested with one-way factorial analyses of variance for continuous outcomes and chi-squared analyses for categorical outcomes. Statistically significant effects of perceived competitiveness were followed up with post-hoc between-groups comparisons using Tukey "honestly significant difference" tests for continuous outcomes, and pairwise tests between percentages for categorical outcomes. An alpha of .05 was used for all inferential analyses.

RESULTS

We received 532/1748 (30.4%) survey responses from US-senior allopathic medical students applying to EM in the 2018 NRMP Match cycle. The demographics of respondents are shown in Table 1. These demographics were compared to “Charting Outcomes in the Match of US Allopathic Seniors,” a report released by the NRMP. The respondents’ mean Step 1 (231.6) and Step 2 (246.6) scores were similar to the national means of EM (233 and 247, respectively), as was the percentage of AOA students (14.5% in our cohort, 12.4% nationally). The average number of programs applied to per applicant was 49.1.

We performed an analysis to correlate the information provided by the students with their perceived competitiveness (Table 2). There were strong and statistically significant correlations between self-perceived competitiveness with estimated class rank, AOA status, USMLE Step 1 score, and USMLE Step 2 clinical knowledge (CK) score.

Information related to external factors that might have influenced applicant perspective on numbers of applications is represented in Table 3. We found that 61.1% of respondents reported that input from peers going into EM led to an increase in the number of applications submitted. USMLE scores were the next most likely external factor to increase application numbers (46.9%). Other factors surveyed showed minimal effects. The most variability in response was seen in the category “advice from EM faculty advisors”: 37.7% of respondents reported an increase in the number of applications; 26.1% reported a decrease; and 33.3% reported no effect from advice.

The results of personal factors relating to EM application numbers are summarized in Table 4. Electronic Residency Application Service (ERAS) cost drove a decrease in applications for 34.3% of respondents. Respondent self-assessment of personal competitiveness increased application numbers in 57.7%. Other personal factors did not have substantial effect on application numbers.

Applicant self-assessment of the number of applications they submitted showed that 47.3% of respondents reported, in retrospect, that they had applied to too many programs, while 40.9% felt they applied to the right number of programs. Only 11.8% believed they had applied to too few.

We performed subgroup analysis on students based on their self-perceived competitiveness. This information is available in Table 5. There was a strong and statistically significant association between “self-perceived competitiveness” and the “number of programs applied to in Emergency Medicine” ($F(2, 504) = 84.4, P < .001$); those who perceived themselves as “less competitive” applied to considerably more EM programs compared to those who self-perceived as “competitive” and “very competitive.” Students who self-assessed as “less competitive” were also statistically significantly more likely to indicate that they applied to too few EM programs ($\chi^2[4] = 67.3, P < .001$) and went on

statistically significantly fewer EM interviews ($F[2,504] = 27.7, P < .001$).

In addition, compared to those who self-perceived as “competitive” and “very competitive,” those who perceived themselves as “less competitive” were statistically significantly more likely to increase the number of applications submitted for EM residency due to the influence of self-assessment of personal competitiveness ($\chi^2[6] = 138.2, P < .001$) and USMLE scores ($\chi^2[6] = 90.1, P < .001$); and statistically significantly less likely to decrease the number of applications submitted for EM residency due to the influence of personal geographic limitations ($\chi^2[6] = 22.8, P = .001$). Results also showed that compared to those who self-perceived as “very competitive,” those who perceived themselves as “less competitive” were statistically significantly more likely to increase the number of applications submitted for EM residency due to the influence of the Visiting Student Application Service (VSAS)/Away rotation experience ($\chi^2[1] = 12.1, P < .001$); social media resources ($\chi^2[1] = 8.2, P = .004$); and having a faculty advisor in EM ($\chi^2[1] = 5.3, P = .02$). “Less competitive” students were statistically significantly more likely to indicate that ERAS cost was not relevant to the number of applications submitted for EM residency ($\chi^2[1] = 6.8, P = .009$).

Those who perceived themselves as “less competitive” were not statistically significantly more likely to increase the number of applications submitted for EM residency due to the influence of peers going into EM ($\chi^2[6] = 8.1, P = .23$), but those who perceived themselves as “very competitive” were statistically significantly less likely to endorse this item compared to those who perceived themselves as “competitive” ($\chi^2[1] = 6.5, P = .01$). Finally, there were no statistically significant associations between self-perceived competitiveness and the number of applications submitted for EM residency due to the influence of other factors listed.

DISCUSSION

Nearly half of US-senior allopathic EM residency applicants felt they had applied to too many programs in the 2018 NRMP Match application cycle. Based on correlations with objective achievement measures in the ERAS application, EM applicants as a whole were able to stratify themselves into relative zones of competitiveness. While the subgroup of “very competitive” applicants was more likely to report a decrease in applications due to their self-perceived competitiveness, 57.7% of total respondents said their self-assessment of competitiveness led to an increase in their number of applications. As this percentage outstrips the number of respondents who self-perceived as “less competitive,” it suggests that even applicants who viewed themselves as “competitive” felt the pressure to increase application numbers.

The reason behind this phenomenon, and our finding

Table 1. Demographics (N = 532) of allopathic medical students in the United States applying to emergency medicine residency.

Variable	% or M (SD)
Gender	
Female	38.2
Male	61.7
Other	0.1
Race/ethnicity	
Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native	12.5
Black or African American	4.1
Hispanic/Latino	5.2
White	68.4
Other or more than one race	7.3
No response or decline to answer	2.4
Estimated class rank ^a	
Lower third	13.9
Middle third	47.6
Upper third	38.5
Geographic area of medical school	
East North Central Midwest (IL, IN, MI, OH, WI)	22.7
East South Central (AL, MS, KY, TN)	1.9
Middle Atlantic (NJ, NY, PA)	22.4
Mountain West (AZ, CO, ID, MT, NM, NV, UT, WY)	4.3
New England (CT, MA, ME, NH, RI, VT)	5.3
Pacific West (AK, CA, HI, OR, WA)	7.7
South Atlantic (DC, DE, GA, FL, MD, NC, SC, VA, WV)	17.1
West North Central Midwest (IA, KS, MN, MO, ND, NE, SD)	7.3
West South Central (AR, LA, OK, TX)	11.3
USMLE Step 1 score	231.6 (17.6)
USMLE Step 2 CK score	246.6 (15.6)
Elected to the AOA Honor Society while in medical school? (% yes)	14.5
How would you rank your competitiveness as an applicant in emergency medicine? ^b	
Less competitive	12.4
Competitive	52.2
Very competitive	35.5
How many programs did you apply to in emergency medicine?	49.1 (23.2)
How many INTERVIEWS in emergency medicine did you go on?	13.2 (4.2)
How many EM programs did your main EM faculty advisor recommend that you apply to?	38.4 (14.3)

^aFor this variable, 4.3% of the data were missing.

^bFor this variable, 4.1% of the data were missing.

SD, standard deviation; USMLE, United States Medical Licensing Examination; AOA, Alpha Omega Alpha Honor Medical Society; EM, emergency medicine.

that the most substantial driver of increase in applications is peers going into EM, has been explained by others in medical education through game theory, particularly the prisoner's dilemma paradox.⁷⁻¹⁰ In the prisoner's dilemma, because direct cooperation isn't possible and the larger payoff is

thus uncertain, two individuals demonstrate self-interest and choose an option that minimizes their personal risk. In the application process, this translates to applicants choosing to overapply to mitigate the risk to themselves should their colleagues overapply, which they presume will happen.

Table 2. Competitiveness analysis (N = 532).

Variable	Competitiveness self-identification			Total	P-value
	Less competitive	Competitive	Very competitive		
Estimated class rank					
Lower third	34 (54.0%)	32 (12.0%)	5 (2.8%)	71 (13.9%)	< .001
Middle third	28 (44.4%)	171 (64.3%)	44 (24.3%)	243 (47.6%)	
Upper third	1 (1.6%)	63 (23.7%)	132 (72.9%)	196 (38.4%)	
AOA status					
No AOA chapter	1 (1.6%)	10 (3.8%)	16 (8.8%)	27 (5.3%)	< .001
No	62 (98.4%)	247 (92.9%)	101 (55.8%)	410 (80.4%)	
Yes	0 (0.0%)	9 (3.4%)	64 (35.4%)	73 (14.3%)	
USMLE Step 1 score, mean (SD)	218.1 (14.2)	229.1 (15.8)	239.8 (17.2)	231.5 (17.6)	< .001
USMLE Step 2 CK score, mean (SD)	232.6 (12.6)	246.2 (13.0)	251.9 (16.9)	246.5 (15.6)	< .001

USMLE, United States Medical Licensing Examination; AOA, Alpha Omega Alpha Honor Medical Society; CK, clinical knowledge.

Table 3. How did each of the following factors influence you to change the number of applications submitted for emergency medicine residency? (N = 532).

Variable	Percentage responded			
	Increase	Decrease	No effect	Not used
Peers going into EM	61.1	5.2	31.1	2.6
USMLE scores	46.9	23.6	28.7	0.8
Faculty advisor in EM	37.7	26.1	33.3	2.8
VSAS/Getting and doing an away rotation	29.5	15.2	50.3	5.0
Dean/Student Affairs advisor	24.8	5.6	47.1	22.6
Social media resources	19.2	1.6	44.5	34.7
Formal online advising resources from EM	18.2	7.2	45.5	29.1
eSLOE(s) processes	16.2	6.4	62.1	15.4
Peers going into other specialties	15.4	2.4	71.7	10.6
Standardized video interview (SVI)	13.6	1.8	74.1	10.6

USMLE, United States Medical Licensing Examination; EM, emergency medicine; VSAS, Visiting Student Application Service; eSLOE, electronic standardized letter of evaluation.

Table 4. How did each of the following personal factors influence you to change the number of applications you submitted for emergency medicine residency? (N = 532).

Variable	Percentage responded			
	Increase	Decrease	No effect	Not used
Self-Assessment of personal competitiveness within specialty	57.7	18.0	22.8	1.6
Personal geographic limitations	17.6	26.7	46.3	9.4
Couples match or other significant other considerations	14.8	1.8	18.6	64.9
ERAS cost	0.6	34.3	56.3	8.8

ERAS, Electronic Residency Application Service.

Table 5. Subgroup analysis by allopathic medical students' self-perceived competitiveness (N = 532).

Variable	Competitiveness self-identification ¹			Comparisons		
	Less competitive (n=63, 12.3%)	Competitive (n=266, 52.2%)	Very competitive (n=181, 35.5%)	P-value for LC vs. C	P-value for LC vs. VC	P-value for C vs. VC
How many programs did you apply to in EM?	75.7	50.9	37.4	<.001**	<.001**	<.001**
Percent indicating that they applied to "too few" EM programs.	36.7%	12.9%	1.7%	.003*	<.001**	.02*
How many INTERVIEWS in EM did you go on?	9.8	13.3	14.2	<.001**	<.001**	.02*
Percent indicating that SELF-ASSESSMENT OF PERSONAL COMPETITIVENESS influenced them to increase the number of applications submitted for EM residency.	93.3%	69.7%	27.7%	.04*	<.001**	<.001**
Percent indicating that USMLE scores influenced them to increase the number of applications submitted for EM residency.	81.7%	52.7%	26.6%	<.001**	<.001**	.001*
Percent indicating that PERSONAL GEOGRAPHIC LIMITATIONS influenced them to decrease the number of applications submitted for EM residency.	8.3%	25.4%	35.0%	.004*	<.001**	.03*
Percent indicating that VSAS-EXPERIENCE OF GETTING & DOING AN AWAY ROTATION influenced them to increase the number of applications submitted for EM residency.	41.7%	33.7%	19.2%	.24	<.001**	<.001**
Percent indicating that SOCIAL MEDIA RESOURCES influenced them to increase the number of applications submitted for EM residency.	28.3%	21.6%	12.4%	.26	.004*	.01*
Percent indicating that FACULTY ADVISER IN EM influenced them to increase the number of applications submitted for EM residency.	50.0%	37.9%	33.3%	.08	.02*	.32
Percent indicating that ERAS-COST was not relevant to the number of applications submitted for EM residency.	16.7%	6.4%	9.6%	.009*	.14	.22
Percent indicating that PEERS GOING INTO EM influenced them to increase the number of applications submitted for EM residency.	58.3%	66.3%	54.2%	.24	.58	.01*

¹n = 22 (4.1%) has missing data on this variable.

*p<.05. **p<.001.

EM, emergency medicine; LC; less competitive; C, competitive; VC, very competitive; USMLE, United States Medical Licensing Examination; VSAS, Visiting Student Application Service; ERAS, Electronic Residency Application Service.

Another hypothesis to explain the overapplication phenomenon is prospect theory.¹¹ Prospect theory is a behavioral model that explains how people decide between different options, or prospects, that involve risk and uncertainty. In broad strokes, prospect theory holds that people overweigh losses compared to gains and are therefore more willing to take risks (i.e., pay more money for the residency application process) to avoid losses (i.e., going unmatched), no matter how small the probability of loss.

Given that the motivation for deans of medical schools is that their medical students match successfully, we had thought

this might lead to advice encouraging students to overapply. However, a quarter of respondents reported not consulting their Dean's office at all, while another half reported no effect on their application numbers. This seems to suggest that applicants are instead relying primarily on EM departmental resources (e.g., clerkship directors, trusted faculty, etc.) for application recommendations.

"Less competitive" applicants were statistically significantly more likely to increase their number of applications based on EM faculty advisor advice. This could have represented appropriate advising: "less competitive"

applicants should require more applications to obtain an appropriate number of interviews to increase their chances of matching. However, one-third of “competitive” and “very competitive” applicants also reported an increase in applications based on EM faculty advisor advice. This suggests the possibility that EM advisors are contributing to the cycle of overapplication via their individual advising practices.

We hypothesized that several other factors would potentially increase application numbers, but the effects of these were mixed in our study results. The eSLOE is a critical component of EM residency applications in which writers rank applicants in a variety of clinical and non-clinical domains and in regard to their overall competitiveness as a residency applicant.¹² This element did not appear to affect the majority of respondents despite its importance, potentially because students are blinded to their individual eSLOEs. The standardized video interview (SVI) was not a significant factor in application numbers; further, after our survey the Association of American Medical Colleges decided not to continue the EM-based pilot of the SVI.¹³ Social media resources were also either not used or non-contributory in a majority of applicants, as were peers going into non-EM specialties.

The VSAS and away rotation experience did not have an effect on applicants as a whole. However, “less competitive” applicants showed a statistically significant increased likelihood to report that the VSAS and away rotation experience affected their application numbers. This could represent clerkship directors at away rotations providing appropriate feedback on the applicant’s performance, which could in turn have informed the number of EM programs to which applicants applied. Alternatively, the current expressions of frustration with the away-rotation process, which often relies on an application process for limited slots, may push less competitive students to feel more anxiety surrounding away rotations than those who perceive themselves as more competitive for EM. This anxiety may have influenced those in this subgroup to apply to more programs during the actual residency application process.

USMLE scores were a motivator for increased applications in almost half of respondents. USMLE scores, and Step 1 in particular, are heavily weighted in the residency selection criteria across specialties¹⁴ and have become the primary motivator of the undergraduate medical education learning environment.¹⁵ The students who viewed themselves as less competitive were more likely to view their USMLE Step scores as a reason to increase their number of applications. Students could have been using their USMLE scores as a surrogate for competitiveness, undervaluing other pieces of their application. Alternately, students could have viewed USMLE scores as the application item that program directors find to be the most important, despite ongoing efforts encouraging a more holistic application review.¹⁶ The recent announcement from the Invitational Conference on USMLE

Scoring (InCUS) that USMLE Step 1 will go to a pass/fail scoring system¹⁷ could change this perspective; but Step 2 CK will remain a scored exam.

Proposals for Improving Overapplication

Several proposals have been put forth by the EM community with the hope of decreasing residency application numbers. The CORD-EM Application Process Improvement Committee has developed the Emergency Medicine Applicant Tool of Common Hangups (EMATCH) to increase transparency to students on their competitiveness.¹⁸ However, if already competitive applicants feel the need to overapply because of normal human tendencies demonstrated by the prisoner’s dilemma and prospect theory, it is unlikely that we can depend on applicants to curb overapplication through recommendations and advisement alone. Change in behavior may require external forces.

Over a third of “competitive” and “very competitive” applicants reported that they applied to more programs after speaking with EM faculty advisors. This finding suggests that EM faculty may be a target area for improving EM overapplication. CORD’s Advising Students Committee has worked with EMRA to create an advising guide and several other resources for students to determine how competitive their applications to EM are. However, if faculty advisors provide conflicting advice, this could add to student anxiety over the application process and worsen overapplication. There may be more work to be done by the EM residency education community to provide resources to standardize faculty advising practices.

There may also be a need to place external limitations on overall application numbers. These external limitations may take a variety of forms from overt restriction to systematic barriers to limit applications through increased work or cost to the applicant. Proposals that have been made by the EM community include the following: preventing interview double-booking through the use of a centralized interview scheduling system; limiting all EM residency interviews to one particular day of the week to limit the number of possible interviews an applicant can attend; increasing application costs; and increasing the difficulty of residency program application by mandating that applicants write program-specific letters of intent, similar to the process in place for the otolaryngology match.¹⁹ These solutions may also potentially serve to benefit applicants with greater financial and temporal means. Even so, prospect theory states this intervention will not work; applicants will take the additional loss of money to avoid not matching, just as they will take on the added administrative burden of program-specific applications.

The ultimate, yet extreme, solution may revolve around limiting or sequencing the number of applications an applicant can submit. However, this solution may be disadvantageous to applicants with unique situations, such as participation in a couples match, particularly if the two

specialties are not synchronized with application review and interview times. Another solution proposed by Berger and Cioletti includes changing the entire match process to several rounds (limiting the number of applicants during each round), rather than the current process of one round of match followed by the Supplemental Offer and Acceptance Program.⁹ This model is also currently being explored by the American College of Obstetrics and Gynecology via the American Medical Association Reimagining Residency Grants.²⁰ Whipple et al ran a variety of computer simulation models of the otolaryngology match examining a preference-weighted application.²¹ They found that the use of student-provided preferences (the ability to select a limited number of programs as their “preferred programs”) decreased the gap in the number of interviews received by the most and least competitive applicants and allowed programs to review more applicants without resorting to metric-based screening. The potential implications of these proposals on both program and applicant require extensive exploration.

LIMITATIONS

While on objective metrics our respondents appear to closely match the overall EM applicant pool and suggest a representative sample, we captured only 30.4% of US allopathic senior applicants in the 2018 cycle. The distribution strategy of our survey likely contributed to this. While the use of public forums and listservs and total anonymity may have allowed respondents to feel comfortable entering sensitive information, it precluded follow-up to increase survey capture of the polled population. Our small sample size could have introduced confounders based on the percentage of the applicant pool most likely to respond to the survey. In order to best invite honest reporting, no specific measures could be taken to prevent anonymous participants from taking the survey more than once, which presents an additional confounder.

In addition, the distribution through listservs may also have biased responses toward those groups most connected to these administrative resources and the recommendations offered through them. Additionally, our survey relied on subjective data (competitiveness in EM), which introduces a possible confounder based on the inaccuracy of self-assessment. When looking at the geographic data by census tracts of each respondent, there were signs of overrepresentation of certain areas of the country with East North Central Midwest, Middle Atlantic, and South Atlantic regions being over-represented and the East South Central, Mountain West, New England, West North Central Midwest, and Pacific West being under-represented.

While we obtained information on the number of interviews applicants performed, we did not obtain information about the number of interview offers they received. Any excess of interview offers received compared to interviews completed could have affected applicant self-

assessment and provided insight into disparities between the competitiveness subgroups.

We broke our respondents into subgroups based on their self-perceived competitiveness to further the evaluation of trends in “less competitive,” “competitive,” and “very competitive” subgroups. Without information on the respondents’ eSLOEs or individual achievements that are very real contributors to the strength of an application,²² a true competitiveness assessment was impossible. The correlation of self-perceived competitiveness with USMLE Step 1 and Step 2 CK scores, AOA status, and estimated class rank provide some validity evidence to the accuracy of this perception, but with the recognition that these markers provide only one aspect of an applicant’s competitiveness.

CONCLUSION

Our results suggest that individual applicant’s EM application behavior is substantially influenced by peers. While frustrating to programs and applicants, the logical framework behind each applicant’s decision to overapply is not unusual based on known game-theory models. The EM application process has created an environment that has fueled overapplication. External limitations to applications numbers may be needed to create meaningful change in EM residency applicant behavior.

Address for Correspondence: Robert D. Huang, MD, Department of Emergency Medicine, University of Michigan – Michigan Medicine, 1500 E. Medical Center Drive, B1-380 Taubman Center, SPC 5305, Ann Arbor, Michigan, 48109-5305. Email: robdw@med.umich.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Nationwide Survey of Program Directors on Resident Attrition in Emergency Medicine

Andrew Mittelman, MD

Madeline Palmer, MD

Julianne Dugas, MPH

Jordan A. Spector, MD, MS

Kerry McCabe, MD

Alexander Y. Sheng, MD, MHPE

Boston Medical Center, Department of Emergency Medicine, Boston, Massachusetts

Section Editor: Danielle Hart, MD, MACM

Submission history: Submitted May 18, 2020; Revision received October 20, 2020; Accepted October 27, 2020

Electronically published December 14, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.48286

Introduction: Despite the burdens that resident attrition places upon programs and fellow trainees, emergency medicine (EM) as a specialty has only begun to explore the issue. Our primary objectives were to quantify attrition in EM residency programs and elucidate the reasons behind it. Our secondary objectives were to describe demographic characteristics of residents undergoing attrition, personal factors associated with attrition, and methods of resident replacement.

Methods: We conducted a national survey study of all EM program directors (PDs) during the 2018-2019 academic year. PDs were asked to identify all residents who had left their program prior to completion of training within the last four academic years (2015-2016 to 2018-2019), provide relevant demographic information, select perceived reasons for attrition, and report any resident replacements. Frequencies, percentages, proportions, and 95% confidence intervals were obtained for program- and resident-specific demographics. We performed Fisher's exact tests to compare reasons for attrition between age groups.

Results: Of 217 PDs successfully contacted, 118 completed the questionnaire (response rate of 54%). A third of programs (39 of 118) reported at least one resident attrition. A total of 52 residents underwent attrition. Attrition was most likely to occur prior to completion of two years of training. Gender and underrepresented minority status were not associated with attrition. Older residents were more likely to leave due to academic challenges. The most common reported reason for attrition was to switch specialties. Resident replacement was found in 42% of cases.

Conclusion: One-third of programs were affected by resident attrition. Gender and underrepresented minority status were not associated with attrition. [West J Emerg Med. 2021;22(1)86-93.]

INTRODUCTION

Resident attrition is often defined as the premature loss of a resident prior to completion of training.^{1,2} Attrition has the potential to negatively impact fellow trainees and program leadership.³⁻⁶ It can harm future recruitment efforts.^{3,7} Attrition can even indirectly affect patient care by "reducing services to patients and disrupting continuity of care."⁶ Despite the impact, there is a paucity of literature in emergency medicine

(EM) exploring the reasons behind, and the risk factors for, attrition. The existing research on attrition arises primarily from the surgical literature. Little has changed since Naylor et al highlighted over a decade ago that "predictors of performance and attrition have proved to be elusive."⁷

The field of EM has just begun to address the scope of this important issue. Brockberg et al showed that a quarter of EM residencies are impacted by resident attrition each

year.¹ Our primary objectives were to quantify resident attrition in EM training programs and elucidate the reasons behind it. Our secondary objectives were to describe demographic characteristics of residents undergoing attrition, personal factors associated with attrition, and avenues of resident replacement.

METHODS

We performed a survey study of all Accreditation Council for Graduate Medical Education (ACGME)- accredited EM residency programs in the United States during academic year 2018-2019. We defined resident attrition as the permanent departure of a trainee from the residency program prior to graduation. Residents on temporary leave who subsequently returned were excluded. Program directors (PDs) were asked to identify all residents who left their program prior to completion of training within the prior four academic years (2015-2016 to 2018-2019).

We used an iterative process to generate the questionnaire. We initially piloted the questionnaire at our institution with three residents, one EM PD and one former EM PD, as well as three associate/assistant program directors (APDs). After incorporating suggestions, we piloted the revised questionnaire again with eight residents, one EM PD, and three APDs from our institution. The questionnaire was finally piloted with two PDs from different institutions. The final version of the distributed questionnaire is shown in Appendix A.

The questionnaire includes demographic data about the residency program including class size, defined as small (≤ 6 residents per class), medium (7-12), or large (> 12), and length (3 vs 4 years). PDs were asked to identify the characteristics of residents who underwent attrition (years of training completed, marriage status, parental status) and the perceived reasons for why each resident left. Selection of multiple reasons for each incidence was permitted. All of the demographic inquiries that would undergo statistical analysis were decided on a priori. We chose the demographics based on our literature review of attrition analyses in other specialties, particularly those characteristics that are more likely known to PDs in order to maintain accuracy of the results and reduce potential missing data. Additional variables were collected to describe the cohort of residents undergoing attrition.

Using the ACGME database,⁸ we identified 241 ACGME-accredited EM programs and gathered a list of PD emails for each training program. The questionnaire was first distributed via email during October 2018. Two reminders were sent to non-responders, first in November 2018 and again in April 2019 after the completion of interview season. Data collection did not occur during interview season, as PDs were less likely to have time to accurately complete the questionnaire. Completion of the questionnaire was voluntary. All questionnaire responses were anonymous. The study was deemed exempt by our institutional review board.

Data Analysis

Questionnaire creation and data collection were done using Research Electronic Data Capture (REDCap)⁹ hosted at Boston University, CTSI 1UL1TR001430. Frequencies, percentages, proportions, and 95% confidence intervals (CI) were obtained for relevant program- and resident-specific demographics. We used one-sample proportion tests to compare demographics of the sample to those of residents nationwide and to the expected number of attritions per training year. The expected number of attritions per training year was a weighted average of 33% of residents per PGY at three-year programs and 25% of residents per PGY at four-year programs. A chi-squared test was used to assess the association between program length and attrition, and we used Fisher's exact tests to compare reasons for leaving between gender and age groups. To decrease the probability of a Type I error, we applied the Bonferroni method¹⁰ wherein the original alpha level of 0.05 was divided by 32 (our total number of hypothesis tests performed) to obtain the conservative alpha level of significance of 0.0016. *P*-values less than 0.0015 were considered statistically significant. We did all analyses using SAS v9.4 (SAS Institute, Cary, NC).

RESULTS

Of the 241 PD email addresses identified, 24 did not successfully reach the intended recipient (eg, firewalls, email bouncebacks), yielding a total sample size of 217 programs. Of this cohort, 118 PDs successfully completed the questionnaire, representing 49% (118/241) of EM programs nationwide and a response rate of 54% (118/217) among those successfully contacted. Background information regarding the EM program sample is shown in Table 1. Eighty-seven (73.7%) of the programs in our sample were three-year programs, which mirrors the national proportion of three-year EM programs (75.0%; $Z = -0.3189$, $P = 0.7498$).¹¹

Table 1. Program characteristics and attrition rate (n = 118 programs).

Program characteristics	n	%
Average class size		
Small (≤ 6)	16	13.6
Medium (7-12)	60	50.9
Large (≥ 13)	42	35.6
Length of residency		
3 years	87	73.7
4 years	31	26.3
Incidents of attrition		
0 attritions	79	67.0
1 attrition	29	24.6
2 attritions	7	5.9
3 attritions	3	2.5

Thirty-nine programs (33.1%) reported at least one instance of attrition during the 40-month window of interest (July 2015–October 2018). Seven programs lost two residents, and three programs lost three residents. Twenty-seven (51.9%) instances of attrition occurred in three-year programs and 25 (48.1%) in four-year programs, reflecting that 31% (27/87) of three-year programs and 81% (25/31) of four-year programs were affected by attrition. We noted a significant association between program length and attrition ($\chi^2 = 22.8226$, $P < 0.0001$). Of those who underwent attrition after completion of two years of training ($n = 7$), six (85.7%) were enrolled in four-year programs. Based on our sample's composition of resident attrition occurring in 27 three-year programs and 25 four-year programs, we would expect to see an average of 29% of residents leave per postgraduate year. In contrast, our results suggest that trainees left disproportionately early in training, as 45 residents (86.5%) left before completing two years ($Z = 9.1062$, $P < 0.0001$).

A total of 52 residents were identified as having experienced attrition. Their characteristics and avenues of replacement are described in Table 2. Of the 52 residents who experienced attrition, 69% (36/52) were men; this proportion does not differ significantly from the nationwide cohort of EM residents, of which 64% ($n = 4758$) are men ($Z = 0.7858$, $P = 0.4320$).¹¹ Moreover, the proportion of attritions that occurred among underrepresented minority (URM) residents (0.1765, 95% CI, 0.0934-0.3048) was not significantly different from the proportion of URM EM residents nationwide (0.1903, 95% CI, 0.6952-0.9066; $Z = -0.2516$, $P = 0.8014$).¹¹ Finally, among the medical doctor/doctor of osteopathic medicine (MD/DO) subset of our sample ($n = 51$, after exclusion of $n = 1$ international medical graduate [IMG]), the MD attrition percentage did not differ significantly from the national composition (70.6% vs 77.1%, $P = 0.2676$).¹¹

Of the 52 residents identified in our study, 45 (86.5% (95% CI, 74.4-93.6)) left prior to completion of two years of training. Twenty-two residents who underwent attrition (42.3%) were subsequently replaced in their respective programs. Replacements were most commonly found with the assistance of the Council of Residency Directors in Emergency Medicine (CORD) Listserv or Society of Academic Emergency Medicine Residency Vacancy Services (SAEM). No replacements were found using the Association of American Medical Colleges, openresidencyposition.com, or residentswap.org. Table 3 depicts the perceived reasons for resident attrition. According to PDs, no residents left due to financial concerns, military commitments, or sequelae from a difficult clinical case.

PDs had the option to select multiple reasons for each incidence of attrition. On average, 1.73 (standard deviation = 0.93) reasons for leaving were identified per resident. The most commonly cited reason for attrition was a desire to change specialty. Academic challenges and professionalism issues combined yielded a similar number of resident

attritions. Trainees most commonly switched into internal medicine, anesthesia, and family medicine (Table 3).

The PD-perceived reasons for attrition stratified by gender are shown in Figure 1. Males were relatively more likely than females to leave due to academic challenges (27.8% vs 12.5%) or professionalism (25.0% vs 12.5%), but the differences were not significant ($P = 0.3010$ and $P = 0.4679$, respectively). Substance use and legal troubles were rare. There were no significant associations between gender and any individual reason for leaving.

Residents older than 30 were significantly more likely to leave due to academic challenges (50.0% vs 8.8%, $P = 0.0015$). Relative to younger residents, older residents were *not* more likely to leave due to any other reason including personal/family illness (11.1% vs 11.8%, $P = 1.0000$) or for spouse or family relocation (0.00% vs 8.8%, $P = 0.5431$).

DISCUSSION

Program Characteristics

Over the 40-month window of interest, 39 of the 118 EM training programs (33.1%) lost at least one resident prior to training completion. Comparably, Brockberg et al reported that 23% of EM programs experienced attrition each year and more than 80% experienced attrition over the 10-year period of 2007-2016.¹ Our data is consistent with existing studies demonstrating that while the overall incidence of resident attrition in EM on an individual level is low, a substantial portion of training programs are impacted.

We noted a significant association between program length and attrition. The reason behind the higher rate of attrition in four-year programs is unclear. In-depth qualitative studies are needed to determine whether inherent characteristics of four-year programs foster dissatisfaction resulting in attrition or whether residents simply have more time to leave before completion of training.

PGY Level

We observed a statistically significant preponderance of attrition occurring prior to completion of two years of training. Although analysis of our data is clouded by the variable length of EM training programs, existing literature in other fields suggests that residents are less likely to experience attrition later in residency.^{6,12-17}

Age

In our analysis, 54% of EM residents who underwent attrition were 26-30 years old. Nationwide, the median age of an EM resident is 29 years, with 59% being 27-30 years old.¹¹ Previous reports on the association of age and attrition are inconsistent. Older age has been previously shown to predict attrition in neurosurgery,¹⁷ obstetrics and gynecology (OB/GYN),¹⁸ and general surgery,⁷ while other studies of surgical fields reported no association with age.^{4,13,19} Naylor et al suggested that age may be predictive of attrition to the extent

Table 2. Characteristics of residents who underwent attrition (n=52) and their avenues of replacement.

Resident characteristics	n	%	Resident characteristics	n	%
Number of residents missing from each class (by expected PGY status at time of questionnaire)			Trained in part or completed residency in another specialty before applying to EM		
PGY-1	10	19.2	Yes	6	11.54
PGY-2	15	28.9	No	45	86.54
PGY-3	19	36.5	Missing	1	1.92
PGY-4	8	15.4	Final rank list position		
Completed years of training			Top 10%	5	9.62
Less than 1 year	13	25.0	Top 1/3	16	30.77
1 year	32	61.5	Middle 1/3	19	36.54
2 years	7	13.5	Lower 1/3	4	7.69
Gender			Unknown	8	15.38
Male	36	69.2	Ties to geographic area		
Female	16	30.8	Grew up in the area	6	11.54
Estimated age			College/medical school, worked in area	7	13.46
<26	6	11.5	Has family living in area	3	5.77
26-30	28	53.9	No ties to the area	29	55.77
31-35	9	17.3	Unknown	6	11.54
36-40	6	11.5	Missing	1	1.92
>40	3	5.8	Resident was replaced		
Underrepresented minority in medicine			Yes	22	42.3
Yes	9	17.3	Using CORD Listserv	7	31.8
No	42	80.8	Using SAEM Residency Vacancy Services	8	36.4
Unsure	1	1.9	Using other means	7	31.8
Marriage status			No	30	57.7
Married	21	40.4			
Unmarried	27	51.9			
Unsure	4	7.7			
Children before starting residency					
Yes	10	19.2			
No	38	73.1			
Unsure	3	5.8			
Missing	1	1.92			
New child or became pregnant during residency					
Yes	6	11.54			
No	42	80.77			
Unsure	3	5.77			
Missing	1	1.92			
Medical school education					
MD from US/Canada allopathic medical school	36	69.23			
DO from US/Canada osteopathic medical school	15	28.85			
International medical graduate	1	1.92			

PGY, Post-Graduate Year; MD, Doctor of Medicine; DO, Doctor of Osteopathic Medicine; EM, Emergency Medicine; CORD, Council of Residency Directors in Emergency Medicine; SAEM, Society for Academic Emergency Medicine.

that “family and lifestyle issues tend to become more important with increasing age.”⁷ This was not observed in our study.

Although older residents were more likely to leave due to perceived academic challenges, they were *not* more likely to leave due to family and lifestyle issues, personal/family illness, or for spouse or family relocation. The differences may be attributable to the fact that that surgical residencies are longer in duration and demand more clinical hours worked compared to EM training, leading to increased opportunity for more lifestyles issues, personal/family illness, and relocation needs to manifest. Our study is the first to report a correlation between age and academic difficulty in any specialty.

Gender

Among our sample, the proportion of male residents did not differ significantly from that of all EM residents

Table 3. Program director perceived reasons for resident attrition.

Reason for departure	n	%
Pursue another specialty	20	38.5
Internal medicine	6	35.3
Anesthesia	4	23.5
Family medicine	4	23.5
Obstetrics	1	5.9
Surgery	1	5.9
Psychiatry	1	5.9
Academic challenges	12	23.1
Professionalism issues	11	21.2
EM not a good fit for their skills	10	19.2
Personal, mental or physical health issues	8	15.4
Pursue EM training in another program	8	15.4
Difficulty adjusting to lifestyle of EM	6	11.5
Personal/family illness	6	11.5
Spouse or family relocation	3	5.8
Non-clinical work consulting, research, etc.	2	3.9
Other	2	3.9
Legal concerns	1	1.9
Substance abuse	1	1.9

EM, Emergency Medicine.

nationwide. Multiple prior studies in the surgical literature suggest that women are more likely to experience attrition than men.^{4,7,12,14,17,19–23} The difference is so large as to imply that “gender has been uniformly associated with an increased risk of attrition in surgical training programs.”²⁴ Possible reasons include lack of role models or mentors, discrimination or the perception of it, and sexual harassment.^{12,20,23} Only two studies (one from plastic surgery and one from OB/GYN) found that men were more likely than women to leave prematurely,^{24,25} although findings have been disputed.⁶ A single study in EM evaluating attrition rates between academic years 2006–2007 to 2015–2016 found that women had a higher rate of attrition than men.² We did not observe a gender effect in our study. The discrepancy may be due in part to differences in study methodology, as well as recent efforts to identify and reduce barriers toward becoming a more female-friendly specialty.^{26,27}

Underrepresented in Medicine (URM) Status

Of the residents who underwent attrition, 81% were identified by the PD as “not URM.” Existing surgical literature has suggested that race and ethnicity, specifically Hispanic ethnicity, may be predictors of attrition,²¹ while White race and non-Hispanic ethnicity were shown to be “consistently protective” against attrition.²¹ Similarly in OB/GYN, URM status (defined as Black, Native Hawaiian/Pacific Islander, or American Indian/Alaskan Native) has been identified as an

independent predictor of attrition.¹⁸ We did not observe any such effect in our cohort. The proportion of URM attritions did not differ significantly from the proportion of URM EM residents nationwide.¹⁰

Marital Status and Children

Of the 52 residents who experienced attrition, 21 were married (40.4%), 27 were unmarried (52%), and in four instances the marriage status was not known to the PD (7.7%). Some studies in the surgical literature have shown marriage to be protective against attrition,^{21,22,24,28,29} although others show no association.^{4,13} In our dataset, the majority of residents who underwent attrition (74.5%) entered residency without having children, and did not have a new child during their training (82.4%). The existing literature does not report any association between childrearing before or during residency and attrition.^{13,29} In fact, one group noted childrearing to be protective against attrition in orthopedic residencies.²²

Geographic Factors

The majority (29/52, 55.8%) of residents who underwent attrition had no ties to the geographic area of their residency. A subset grew up in the area (six residents, 11.5%) or had family living in the area (three residents, 5.9%). Prior research suggests a paradoxical impact of having geographic ties and family nearby. In the surgical literature, non-White women with family nearby had attrition rates as high as 39%. Similar trends were noted in men. Males at large surgical programs in the Northeast with family close by were found to have attrition rates as high as 40% – the highest subgroup incidence noted in any male group in the literature.²¹ The authors posited that nearby family may distract trainees from clinical duties.²¹ Ottenhausen et al also observed higher attrition rates in residents training near where they grew up.¹⁹ Our dataset was too small to identify any association between geographic ties, proximate family, and attrition.

Medical Training

Thirty-six of the residents who underwent attrition (69.2%) were MD graduates from USA/Canadian allopathic medical schools. By comparison, MDs comprise 77% of the nationwide cohort of EM residents.¹¹ Among the MD/DO subset of our data (n = 51, after exclusion of the one IMG), the MD attrition percentage did not differ significantly from the national composition.¹¹ Our findings are in agreement with one OB/GYN study that noted similar rates of attrition based upon degree (3.4% for US-trained MDs vs 4.1% for US-trained DOs), although it is worth noting that current trends in MD/DO enrollment are not known in all fields.²⁵

Rank List

Within our cohort, five of the residents (9.6%) who underwent attrition were considered to have been in the top 10% of their programs’ rank lists while four residents (7.7%)

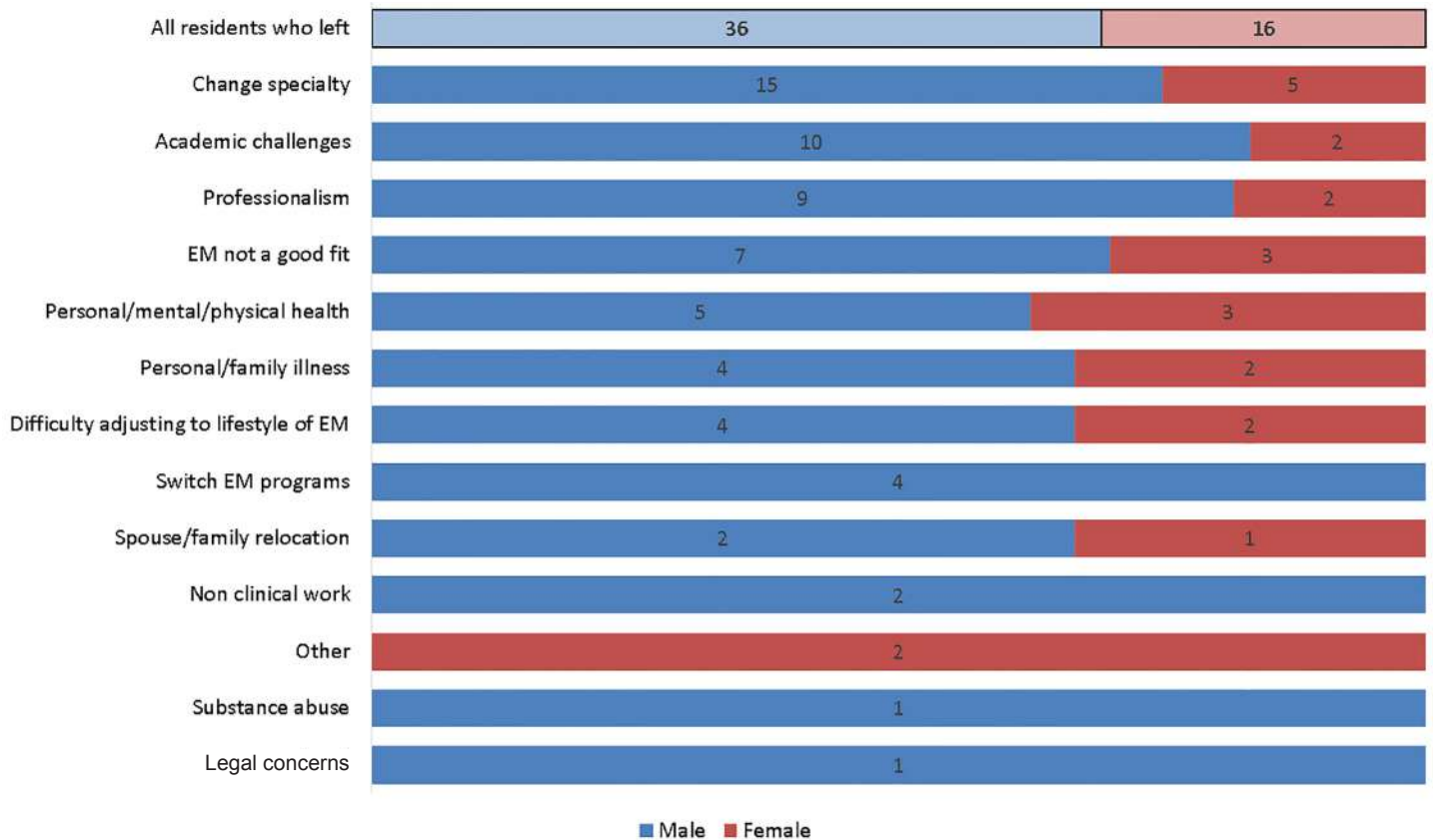


Figure 1. PD perceived reasons for attrition, by gender. PD, program director; EM, emergency medicine.

were initially ranked in the lower 1/3 of candidates. Since programs match fewer residents in the top 10% (due to the competitive nature of their applications resulting in multiple programs vying to match them) and the bottom third of their rank list (due to lack of interest from the program), fewer are susceptible to attrition. Those considered to be in the top 1/3 and middle 1/3 of their programs' rank list were the most likely to undergo attrition, and at similar rates (Table 2), likely due to the fact that the majority of matched residents in a program were ranked as such. Without knowing the true denominator of how many residents were ranked at each program, we could not establish an association between rank list position and attrition. Nevertheless, our findings align with existing literature, which suggests that an individual's position on the rank list is not associated with future attrition.⁷

Resident Replacement

It is unclear from our data how often programs that experienced resident attrition actually sought replacement. However, the fact that a resident replacement was secured in almost half of the cases illustrates the importance of the process to programs and PDs alike. Unfortunately, the existing literature offers little guidance in finding replacements aside

from the reported time and effort it requires.³⁰ The majority of resident replacements in our dataset were found using the CORD listserv or SAEM Residency Vacancy Services while several known resources were not used at all. In terms of predicting future performance, there is evidence in the general surgery literature to suggest that replacement residents are just as likely to succeed as those recruited initially in the match.^{30,31} The performance and graduation rate of the 22 replacement residents is not known.

Reasons for Departure

Most instances of attrition were attributed to multiple perceived reasons (mean 1.73), suggesting that attrition is multifactorial. The most common reason for attrition was a desire to change specialty, corroborating findings noted by Lu et al.² Prior research has shown that men and women depart residency for different reasons.⁵ In the surgical specialties, men are more likely to leave for another specialty, while women are more likely to leave due to issues pertaining to their family or spouse (e.g., relocation).^{6,28} As shown in Figure 1, our data revealed that males were relatively more likely than females to leave due to academic challenges or professionalism (27.8% vs 12.5% and 25.0% vs 12.5%,

respectively), but these differences were not statistically significant. To this end, Lu et al found that men were more likely than women to be “dismissed” from an EM residency.² This is in contrast to data from other fields that has shown no gender gap in dismissal.^{6,22} Substance use and legal troubles were rare in our cohort. No attrition was attributed to financial responsibilities, military commitments, or having been involved in a difficult clinical case / poor patient outcome.

PDs cited academic and professionalism concerns more frequently than lifestyle challenges as having contributed to attrition. This is in contrast to studies in the surgical field, where residents more often leave due to lifestyle factors rather than academic performance.^{4,12} It is possible that lifestyle issues are less prominent in EM and hence other causes of attrition predominate.

LIMITATIONS

Our study has several limitations. Our methods did not capture responses from all 241 programs, as 24 recruitment emails “bounced back” and an additional 46% (99/217) were delivered without any response. Nevertheless, our sample is representative of the national cohort as three-year programs comprised 74% of our residencies who responded, nearly identical to the national composition trend (75% of all ACGME-accredited EM training programs are three years in duration).¹⁸ A source of potential selection bias exists as PDs affected by attrition may have been more or less willing to complete the questionnaire. For example, PDs from programs with few or no recent cases of resident attrition may have been less motivated to complete the questionnaire.

The responses were subject to recall bias, and in several instances the information was unknown to the PDs. The PDs’ responses may have been an inaccurate reflection of the reason(s) for attrition. Additionally, a subset of the respondent programs might have recently received accreditation and had not trained a full cycle of residents. The questionnaire was distributed approximately halfway through academic year 2018-2019, and it is possible that some programs went on to experience attrition after data collection had finished. Furthermore, the endpoint of the window of interest was dynamic due to the competing priorities of interview season. Some PDs accounted for attrition through October 2018 while others did not fill out the questionnaire until April 2019. Although we sought to identify all instances of attrition, we did not specifically ask PDs to identify whether each instance was voluntary or involuntary.

CONCLUSION

One-third of residencies in this study were affected by resident attrition across the window of interest. Residents who underwent attrition were unlikely to have completed two years. We found no statistically significant difference in attrition among gender in our cohort. Underrepresented minority residents were not more likely to undergo attrition.

Older residents were not more likely to experience attrition due to family issues, but were more likely to leave training in the face of academic challenges. Substance use disorder was rare. Nearly half of the lost residents were replaced, using resources made available by EM national organizations. Further rigorous qualitative research is necessary to better illustrate PD and resident perspectives on the impact of and reasons behind resident attrition.

Address for Correspondence: Andrew Mittelman, MD, Boston Medical Center, Department of Emergency Medicine, 800 Harrison Avenue, BCD Building, 1st Floor, Boston, MA 02118. Email: andrew.mittelman@bmc.org.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Emergency Medicine Residents Experience Acute Stress While Working in the Emergency Department

Adam J. Janicki, MD, MS*

Stephanie O. Frisch, PhD, MSN, RN†

P. Daniel Patterson, PhD, NRP*

Aaron Brown, MD*

Adam Frisch, MD, MS*

*University of Pittsburgh, School of Medicine, Department of Emergency Medicine, Pittsburgh, Pennsylvania

†University of Pittsburgh, School of Nursing, Department of Acute and Tertiary Care, Pittsburgh, Pennsylvania

Section Editor: Danielle Hart, MD, MACM

Submission history: Submitted April 9, 2020; Revision received October 26, 2020; Accepted October 28, 2020

Electronically published December 11, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.10.47641

Introduction: Acute stress may impair cognitive performance and multitasking, both vital in the practice of emergency medicine (EM). Previous research has demonstrated that board-certified emergency physicians experience physiologic stress while working clinically. We sought to determine whether EM residents have a similar stress response, and hypothesized that residents experience acute stress while working clinically.

Methods: We performed a prospective observational study of physiologic stress including heart rate (HR), heart rate variability (HRV), and subjective stress in EM residents during clinical shifts in the emergency department. HR and HRV were measured via 3-lead Holter monitors and compared to baseline data obtained during weekly educational didactics. Subjective stress was assessed before and after clinical shifts via a Likert-scale questionnaire and written comments.

Results: We enrolled 21 residents and acquired data from 40 shifts. Residents experienced an increase in mean HR of eight beats per minute ($P < 0.001$) and decrease in HRV of 53.9 milliseconds ($P = 0.005$) while working clinically. Subjective stress increased during clinical work ($P < 0.001$). HRV was negatively correlated with subjective stress, but this did not reach statistical significance ($P = 0.09$).

Conclusion: EM residents experience acute subjective and physiologic stress while working clinically. HR, HRV, and self-reported stress are feasible indicators to assess the acute stress response during residency training. These findings should be studied in a larger, more diverse cohort of residents and efforts made to identify characteristics that contribute to acute stress and to elicit targeted educational interventions to mitigate the acute stress response. [West J Emerg Med. 2021;22(1)94-100.]

INTRODUCTION

Medical education and clinical practice are stressful endeavors. High emotional and physiologic stress levels may impair cognitive performance and the ability to multitask, both of which are vital in the practice of Emergency Medicine (EM).¹ The ways in which stress impacts performance are not completely understood as performance can be impaired, enhanced or unaffected under stressful conditions. Acute stress levels met by available resources may be perceived positively

as a challenge, enhancing performance; however, those that outstrip available resources may be perceived as a threat and decrease performance.^{1,2,3,4}

The task switching frequently required in the emergency department (ED) environment is particularly vulnerable to the effects of stress.¹ In order to better understand the relationship between stress and performance in the ED, we must first determine if emergency physicians experience an acute stress response. Exposure to stressful situations and anticipation of a

stressful situation contribute to changes in cardiac vagal tone with subsequent increases in heart rate (HR) and decreases in heart rate variability (HRV).⁵ It has previously been demonstrated that board-certified emergency physicians experience a decrease in HRV, a marker of physiologic stress, while working clinically.⁶ Unlike attending physicians, resident physicians have multiple additional available resources to use in the face of acute stress in the clinical environment, such as attending supervision and consultant services. It is unclear whether trainees have a stress response during clinical work and the effects of stress on the clinical learning environment remains unclear.

Residency training is commonly referred to as an extremely stressful endeavor. Previous research has demonstrated that, within simulated environments, resident physicians experience a stress response in the face of high-acuity simulation scenarios.^{7,8} Surgical, critical care, and medicine trainees experience stress as identified by a variety of subjective and physiologic measures while working clinically; however, few studies have assessed EM resident physician acute stress outside of the simulation environment.⁹⁻¹⁴ Mefford and associates demonstrated that EM residents experience a stress response while intubating patients in the operating room during an anesthesiology rotation; however, this clinical environment is dissimilar to the emergency department.¹⁴ Additionally, while it has been recently demonstrated that EM residents experience an acute stress response while caring for critically ill patients, this patient population accounts for only a subset of ED patient volume.¹⁵

It is currently unclear whether EM resident physicians experience an acute stress response while working in the ED. Further, it is unclear whether chronic stress and burnout have an effect on residents' acute stress response while working clinically. We hypothesized that EM resident physicians experience an acute physiologic stress response while working clinically.

METHODS

Study Design and Participants

We performed a prospective observational study evaluating surrogate markers of physiologic stress including HR and HRV in EM residents during clinical shifts with comparison to subjectively rated stress levels. The study was done at an urban, academic, Level I trauma center located in Pittsburgh, PA, with an annual census of over 55,000 patient visits from July 2018–December 2018. The study was approved by the institutional review board at the University of Pittsburgh Medical Center. All participation was voluntary and unpaid, and we obtained written informed consent.

Participants were a convenience sample of postgraduate year (PGY)-1 through PGY-3 EM residents. All residents working at the clinical site during the study period were eligible for enrollment. Exclusion criteria included history of cardiac arrhythmia, cardioactive medication use, and pregnancy.

Measurements

Demographic information, resident experience measured

Population Health Research Capsule

What do we already know about this issue?
High levels of acute stress may affect cognitive performance and task switching, both vital in Emergency Medicine (EM), in a variety of ways.

What was the research question?
Do EM residents experience an acute physiologic stress response as well as subjective stress while working clinically?

What was the major finding of the study?
EM residents experience acute subjective and physiologic stress while working clinically.

How does this improve population health?
Knowing that residents experience acute stress is the first step in understanding how stress impacts performance and how stress may affect patient care.

by the number of days in residency since enrollment, baseline chronic stress level, and burnout measurements were gathered during study enrollment. We assessed participant burnout via two 7-point Likert-scale measures previously validated in the assessment of resident physician burnout – one addressing emotional exhaustion and one depersonalization. The measure is based on the frequency with which participants experience various feelings or emotions with response options ranging from “Never” to “Daily.”¹⁶ Baseline chronic stress levels were assessed using the Perceived Stress Scale, one of the most widely used psychological instruments for measuring the perception of stress. It consists of 10 questions using a 5-point Likert scale (0 - Never, 4 – Very Often) to assess respondent's feelings and thoughts during the prior month.¹⁷

Previous research has demonstrated that HR and HRV are validated measures quantifying physiologic stress.^{18,19,20} While residents were working clinically, HR, detection of dysrhythmias, and HRV were measured via a 3-lead Holter monitor (Nasiff Associates, Inc. Central Square, NY) worn during the entire clinical shift. Clinical shifts were divided into three groups based on start times: morning (7 AM and 11 AM), evening (12 PM and 4 PM) and night (9 PM and 11 PM). Baseline HR and HRV were obtained via Holter measurements during weekly, dedicated educational didactic sessions, when residents are engaged in similar academic stimulation as clinical work. We used the standard deviation of all normal to normal R-R intervals (SDNN) measured in

milliseconds (msec) to assess HR variability. The SDNN is the most commonly used measure of HRV and reflects autonomic influence on HRV.^{21,22} We collected all data within two weeks of enrollment to limit any potential changes in baseline stress, anxiety, and burnout.

Self-reported stress levels were determined before and after the shift via a single-item, 7-point Likert scale modified from a previously validated 10-point item in which participants responded to “What is your current stress level?” with answers ranging from not at all to extremely stressed.²³ Each participant completed this self-assessment just prior to and after their clinical shift. In addition, at the conclusion of their shift residents were asked to “describe the most stressful part of [their] shift” in order to elicit qualitative data to inform future work.

We acquired ED census data and the number of patients evaluated by the resident physician from the electronic health record.

Data Analysis

We assessed changes in HRV via a comparison from baseline in order to isolate individual-level changes. Subjective stress was assessed via the difference between pre- and post-shift scores.

We calculated descriptive statistics for participants’ HR, HRV, and self-reported stress levels. Paired t-test was used to compare baseline and on-shift HRV. We used analysis of variance (ANOVA) to compare physiologic data by PGY level and shift timing. As subjective data was nonparametric, Wilcoxon rank-sum test was used to compare pre- and post-shift subjective stress levels. We used Kruskal-Wallis ANOVA test to compare subjective stress by PGY level and shift timing.²⁴ As HRV is a more specific indicator of acute stress than HR, multiple regression was used to assess the association between HRV and subjective stress levels, chronic baseline stress and burnout, ED census, resident experience, and patients per hour seen by the resident physician. We used analysis of residuals to confirm the assumptions of linearity. *P*-values of < 0.05 were considered statistically significant. All statistical analysis was performed using STATA 15.1 (Stata Corp, College Station, TX).

Qualitative data obtained was analyzed under the assumption that residents would be able to self-identify challenging components of their clinical work. Data were reviewed independently by the study investigators (AJ, AF) who subsequently met to discuss broad themes that emerged from responses. The study investigators discussed at length their independent findings and formulated themes by consensus. To evaluate for face validity, these themes were shared and reviewed with experts in graduate medical education who found the themes to be credible and interpretations accurate.

RESULTS

Of the 23 eligible participants, 21 were included in the study. Two residents were excluded due to medication use.

Our sample included 21 participants with a median age of 28 (interquartile range 26-30); four (19%) were women, and 17 (81%) men. There were six PGY-1, eight PGY-2, and seven PGY-3 level participants. Demographic and baseline stress, burnout, and callousness data are presented in Table 1.

Forty Holter monitor recordings were performed. Residents wore Holter monitors on three different shifts – 14 morning, 19 evening, and 7 overnight shifts. Mean daily ED census was 153 patients (95% confidence interval [CI], 149-157) and residents evaluated a mean of 1.5 patients per hour (95% CI, 1.4-1.7).

The mean baseline HR and SDNN for participants obtained at rest during weekly education didactics was 70 beats per minute and 262.8 msec, respectively. While working in the ED the mean HR was 78 beats per minute. One resident displayed findings concerning for tachyarrhythmia and was referred to cardiology for further evaluation. Data from these recordings were excluded from the analysis. The mean HRV measurements while working clinically was 208.9 msec. Residents experienced a statistically significant increase in mean HR ($P < 0.001$), maximum heart rate ($P < 0.001$), and decrease in HRV as measured by SDNN ($P = 0.005$) while working clinically. There was no difference in physiologic measures by PGY level ($P = 0.11$) or shift timing ($P = 0.57$).

Residents experienced a statistically significant increase in self-reported stress during clinical work ($P < 0.001$), decreasing by PGY level ($P = 0.01$). Overnight shifts caused less subjective

Table 1. Participant demographics assessment (n = 21).

Age, years, median (interquartile range)	28 (27-28)
Gender, n (%)	
Male	17 (81)
Female	4 (19)
Relationship Status, n (%)	
Single	9 (43)
Married/civil partnership	12 (57)
Race, n (%)	
White	20 (95)
Black	1 (5)
Postgraduate year level, n (%)	
PGY-1	6 (29)
PGY-2	8 (38)
PGY-3	7 (33)
Resident experience level, days, mean (SD)	463.7 (279.2)
Baseline burnout, range 2-14, mean (SD)	6.6 (2.7)
Emotional exhaustion, range 1-7, mean (SD)	3.4 (1.2)
Depersonalization, range 1-7, mean (SD)	3.5 (2.0)
Perceived Stress Scale score, range 0-40, mean (SD)	13 (3.8)

PGY, post-graduate year; SD, standard deviation.

acute stress when compared to morning or evening shifts. HRV measured by SDNN was negatively associated with subjective stress levels ($r = 0.26$, $\beta = -0.76$), indicating a correlation between increased physiologic acute stress and subjective acute stress, but this did not reach statistical significance ($P = 0.09$). Detailed comparisons of physiologic and subjective parameters are presented in Table 2.

Acute stress response measured by HRV via SDNN was not associated with resident experience, as measured by number of days in residency, ($\beta = 61.7$, $P = 0.47$), baseline chronic stress and anxiety ($\beta = 1.69$, $P = 0.98$), burnout ($\beta = 0.37$, $P = 0.79$), ED census ($\beta = -1.67$, $P = 0.87$), or the number of patients per hour seen by the resident physician ($\beta = 0.2$, $P = 0.75$). Daily ED census fluctuated around baseline levels.

Resident response to “describe the most stressful part of your shift” elicited multiple responses that were categorized into five broad themes. These findings are presented in Table 3.

DISCUSSION

It is currently unclear how stress impacts performance. It can be impaired, enhanced or unaffected under stressful conditions.^{1,4} In order to better understand the complex relationship between stress and performance in EM trainees, we must first determine if they experience an acute stress response. We demonstrated that our cohort of EM resident physicians experience a physiologic acute stress response while working clinically as well as an increase in subjective stress levels. Although this physiologic stress response may have been correlated with subjective stress levels, this did not reach statistical significance. We suspect this is due to our

relatively small sample size.

In our cohort, subjective stress levels decreased with rising PGY level, however we did not find that physiologic stress decreased significantly with increasing PGY level. This may be because experience affords some protection from the subjective stress response and not the physiologic response, but could also be due to our relatively small sample size, and thus more study is warranted. In addition, residents experienced less subjective stress on overnight shifts when compared to morning or evening shifts.

Prior research has demonstrated that non-EM trainees experience a physiologic stress response while performing high acuity procedures such as central venous access and emergency surgery in both simulated encounters and the clinical setting. Mefford and colleagues recently demonstrated that EM residents experience an acute stress response while intubating patients in the operating room.¹⁴ Additionally, EM trainees experience a physiologic stress response while performing medical resuscitations in a simulation environment and while caring for critically ill patients in the emergency department.^{7-12,15} Although these studies offer vital insight into resident stress, the intensive care unit, operating room, and simulation environment are far different clinical settings than that of an emergency physician in the ED setting. In addition to the physiologic stress response during high-acuity patient encounters during dedicated critical care shifts, residents may experience stress during low-acuity patient encounters with clinical situations outside of their control. Our narrative data suggest that residents often report an acute stress response in situations outside of their

Table 2. Physiologic and subjective parameters of stress.

Physiologic parameters	Baseline	During clinical work	P-value
Heart rate, bpm ^a , mean (95% CI)	70 (67.8-73.2)	78 (74.7-81.7)	$p < 0.001$
Maximum heart rate, bpm ^a , mean (95% CI)	83 (78.4-86.7)	109 (103.6 – 113.8)	$p < 0.001$
Heart rate variability			
SDNN ^b , msec, mean (95% CI)	262.8 (230.8-294.7)	208.9 (184.9-232.8)	$p = 0.005$
Subjective parameters	Pre-shift	Post-shift	P-value
Subjective stress score, range 1-7, median (IQR)	2 (2-3)	4 (3-5)	$p < 0.001$
PGY level			
PGY 1	3 (2-3)	5 (5-5)	$p = 0.01^c$
PGY 2	2 (2-3)	5 (2-5)	
PGY 3	2 (1-2)	3 (3-4)	
Shift timing			
Morning	2 (2-3)	5 (4-5)	$p = 0.03^c$
Evening	2 (2-3)	5 (3-5)	
Overnight	2 (1-3)	2 (2-3)	

^abeats per minute. ^b standard deviation of all normal R-R intervals. ^c Subjective stress levels compared using Kruskal-Wallis analysis of variance.

CI, confidence interval; msec, milliseconds; IQR, interquartile range; PGY, postgraduate year.

Table 3. Themes and examples from “describe the most stressful part of your shift.”

Theme	Examples
Demanding patients	“Patient who frequently presents demanding housing” “Patient unsatisfied by ED care” “Patient with chronic dental pain requesting pain medication” “Patient requesting narcotic pain medication in setting of chronic problem”
Inability to obtain a prompt admission and associated boarding	“Acute liver failure requiring ICU. Spoke with TICU, MICU, and SICU before finding a bed” “Patient was upset with length of stay due to bed availability” “Patient upset with length of stay”
Conflicting interests and disagreements with colleagues	“Dealing with difficult consultants” “Working out an admission between ENT and medicine”
Inability to ensure a diagnosis and symptom resolution	“Discharging patient home with ongoing neuro symptoms and no diagnosis” “Non-acute pathology I couldn’t do anything about”
High-acuity procedure	“Intubating a post arrest patient with a King airway in place” “Placing central line” “Placing an arterial line and a central line” “Trauma airway”

ED, emergency department; ICU, intensive care unit; TICU, trauma intensive care unit; MICU, medical intensive care unit; SICU, surgical intensive care unit.

control such as social demands, inability to ensure a prompt admission, conflicting interests with colleagues, and inability to ensure resolution of symptoms and a prompt diagnosis. In a survey of EM residents, Perina and colleagues found that crowding, boarding, documentation, and ancillary support were top problems that resident identified as affecting their well-being.²⁵ Given these findings, educational interventions that target managing the acute stress response itself may be beneficial. Additional research may better delineate settings in which stress improves performance and how this can be optimized in medical education.

It has been previously demonstrated that early high-stress encounters may result in significant amounts of stress being carried over into other patient encounters, even low-acuity ones.²⁶ Further research in a larger cohort of resident physicians should be performed and more granular data obtained to better assess what is causing the acute stress response, if and how this stress affects performance, and how to best mitigate or manage the acute stress response.

Unlike prior work, our study evaluated both physiologic and subjective stress while working clinically the ED. It has been previously demonstrated that acute stress responses in the simulation setting and clinical setting are similar while caring for critically ill patients; however, much of emergency care in the United States also involves low-acuity and non-emergent presentations.¹² Our study incorporated this low-acuity patient population and demonstrated similar acute physiologic changes and increases in subjective stress.^{12,15} Further, unlike other studies which examined stress at various time points during a clinical shift, we performed continuous HR and HRV monitoring throughout shifts in the hopes of capturing a more global assessment of physiological stress by incorporating the fluctuation in volume, patient acuity, and

challenges experienced in most clinical shifts in the ED.^{10,22}

LIMITATIONS

While prior literature has shown heart rate and heart rate variability change during acute stress, their use as a proxy for stress is imperfect as physiologic parameters can be influenced by other sources such as activity or time of day. Although physical activity while on shift is normally limited to mild intensity walking, standing, and sitting, as evidenced by the absence of tachycardia in our HR data, prior work has demonstrated that any exercise will decrease HRV.²⁷ Further, we assessed baseline HRV during residency didactic conference which takes place weekly from 8 AM to 12 PM; thus, our HRV comparison may not take into account changes in HRV due to physical activity or shift time.

Our study was performed at a single institution and thus may reflect our specific clinical and training environment. Given our small sample size and relative homogeneity of our cohort, a larger study may reveal general trends regarding the specific resident, departmental, and shift characteristics that affect stress. It has been demonstrated that age and gender impact HRV, and therefore, our cohort of primarily male residents may have biased our results.²⁸ Our small sample size limited our ability to stratify by multiple variables, including gender, age, and shift type. Further, although the instrument used to assess subjective stress was modified from tools with validity evidence and was assessed for content validity, it did not undergo additional validation testing. We did not assess subjective stress at fixed intervals throughout the shift which limited our ability to elicit specific clinical situations that provoke an acute stress response. We hoped that our qualitative data would help overcome this limitation by inferring themes for future study. We did not inquire about

caffeine intake or other stimulants which may have affected subject HR; however, it has been previously demonstrated that caffeine does not have an effect on HRV or ventricular extrasystoles in our subject population of young adults.²⁹ In addition, we did not specifically inquire about changes in at home life stressors. We hoped that evaluating subjective stress at the beginning of the shift would capture these acute changes, however the evaluation of physiologic stress did not take this into account.

CONCLUSION

Emergency medicine resident physicians experience acute physiologic changes associated with stress as well as subjective acute stress while working clinically in the ED. EM trainees may experience stress during both high- and low-acuity patient encounters as well as in situations beyond their control. These findings should be studied in a larger, more diverse cohort of residents, and efforts should be made to identify resident, patient, and shift characteristics that contribute to the acute stress response and to determine the impact of acute stress on EM resident performance.

Address for Correspondence: Adam J. Janicki, MD, University of Pittsburgh, School of Medicine, Department of Emergency Medicine, 230 McKee Pl, Suite 500, Pittsburgh, PA 15213. Email: janickiaj@upmc.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Medical and Physician Assistant Student Competence in Basic Life Support: Opportunities to Improve Cardiopulmonary Resuscitation Training

Rohit Gupta, BA*

Stephanie DeSandro, MS, PA-C†

Neil A. Doherty, MS, PA-C†

Aimee K. Gardner, PhD†

M. Tyson Pillow, MD, MEd†

*Baylor College of Medicine, School of Medicine, Houston, Texas

†Baylor College of Medicine, Department of Emergency Medicine, Houston, Texas

Section Editor: Ed Ullman, MD

Submission history: Submitted June 8, 2020; Revision received September 7, 2020; Accepted November 11, 2020

Electronically published December 15, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.48536

Introduction: Medical and physician assistant (PA) students are often required to have Basic Life Support (BLS) education prior to engaging in patient care. Given the potential role of students in resuscitations, it is imperative to ensure that current BLS training prepares students to provide effective cardiopulmonary resuscitation (CPR). The objective of this study was to assess whether current BLS training produces student providers who can deliver BLS in an American Heart Association (AHA) guideline-adherent manner.

Methods: Students at a US medical school were recruited by convenience sampling. BLS performance immediately following a standard AHA BLS training course was evaluated during a two-minute CPR cycle using manikins. We also collected information on demographics, previous BLS training attendance, perceived comfort in providing CPR, and prior experiences in healthcare and providing or observing CPR.

Results: Among 80 participants, we found that compression rate, depth, and inter-compression recoil were AHA guideline-adherent for 90.0%, 68.8%, and 79.3% of total compression time, respectively. Mean hands-off time was also within AHA guidelines. Mean number of unsuccessful ventilations per cycle was 2.2. Additionally, 44.3% of ventilations delivered were of adequate tidal volume, 12.2% were excessive, and 41.0% were inadequate. Past BLS course attendance, prior healthcare certification, and previous provision of real-life CPR were associated with improved performance.

Conclusion: Following BLS training, medical and PA students met a majority of AHA compressions guidelines, but not ventilations guidelines, for over 70% of CPR cycles. Maintaining compression depth and providing appropriate ventilation volumes represent areas of improvement. Conducting regular practice and involving students in real-life CPR may improve performance. [West J Emerg Med. 2021;22(1)101-107.]

INTRODUCTION

Each year in the United States, approximately 209,000 patients experience a cardiac arrest in the hospital and undergo subsequent resuscitative efforts. Another 360,000 will arrest out of the hospital setting and rely on individuals

in the community to recognize the emergency and initiate the appropriate interventions.¹ Provision of Basic Life Support (BLS) consisting of rapid, deep, chest compressions with appropriate ventilation is the cornerstone of resuscitation in both hospital and community settings. Based on outcome

analyses, clear guidelines to administer BLS have been developed. The American Heart Association (AHA) recommends that adult cardiopulmonary resuscitation (CPR) be performed with compressions at a depth of at least two inches and at a rate of at least 100 per minute, allowing for full recoil of the patient's chest.^{2,3} Additionally, ventilation of the lungs should be provided over 1-2 seconds and should not exceed the level of maximal chest rise.^{4,5}

Although advanced interventions such as endotracheal intubation and pharmacologic therapies are often provided by higher level providers during resuscitation efforts, multiple prospective and retrospective analyses have demonstrated that the provision of BLS techniques remains the outcome-determining factor for patients experiencing cardiac arrest.⁶⁻⁸ This includes initiation of effective chest compressions in the first minutes of a cardiac arrest.⁸⁻¹⁰ Therefore, deficits in the BLS skillset of health providers can have a major impact on healthcare institutions and the communities they serve by not only depriving cardiac arrest victims of the benefits of treatment, but also potentially increasing mortality.

Two such groups of health providers that must have BLS competency are medical students and physician assistant (PA) students. The Association of American Medical Colleges (AAMC) identifies the ability to recognize the need for emergent care and initiate early management in decompensating patients as required skills that medical school graduates must be able to perform on the first day of residency.¹¹ The AAMC further specifies that the ability to provide basic and advanced life support is derived directly from these expected areas of competency. The Physician Assistant Education Association Presidents Commission has identified similar requirements for PA graduates.¹² Given that medical and PA students are essential members highly involved in care teams and may be involved in resuscitations, it is imperative to ensure that these individuals meet the high standards for effective BLS administration as well as maintain BLS knowledge throughout their tenure treating patients. This is also important to ensure faculty are confident when entrusting responsibility to these students during resuscitations.

However, the extent to which BLS standards and expectations are being met following current health professions BLS training is largely unknown. Determining this as well as other factors that contribute to BLS competence and long-term retention may not only improve delivery of CPR by medical students, but also instill trust in faculty in involving students in resuscitations. Here, we assessed the adequacy of current BLS training in health professions curricula by measuring CPR performance metrics in medical and PA students following completion of a standard AHA BLS course. We also explored whether previous CPR experience impacts performance, and whether significant differences exist between PA and medical student performance.

Population Health Research Capsule

What do we already know about this issue?
Medical and physician's assistant (PA) students are important members of patient care teams who may be involved in resuscitations during clinical rotations.

What was the research question?
Does current Basic Life Support (BLS) training produce competency in medical and PA students, and what are areas for improvement?

What was the major finding of the study?
Students were deficient in areas of BLS, and previous BLS experience was associated with better performance.

How does this improve population health?
Current BLS education in medical curriculum may need refinement for clinicians to be confident in involving medical and PA students in resuscitations.

METHODS

Participants and Study Setting

This study was conducted at a medical and health professions school located in the United States. A convenience sample of all graduating fourth-year medical students and all first-year PA students at the school (a total of 184 and 40 individuals, respectively, eligible to participate) were invited to participate in the study at the conclusion of their requisite, fully guideline-compliant AHA BLS training classes offered as part of their curricula in March 2015. A total of eight classes across one week were taught, with both PA and medical students mixed in each class. While the specific class instructors varied occasionally across the classes, all courses were taught by AHA-certified BLS instructors. Furthermore, class instruction materials were standardized across all classes, which included lecture-based BLS instruction via AHA videos covering all aspects of BLS (eg, scene assessment, compressions, ventilations, automated external defibrillator use, etc.) as well as standardized times for hands-on practice with manikins. Participation in the study was voluntary; no incentive was provided, and participation had no effect on academic or professional standing.

Assessment of BLS Competency

Within one hour of completing the BLS training course, participants completed a pre-assessment survey requesting

demographic information, previous BLS class attendance, previously received healthcare certifications (eg, emergency medical technician), perceived comfort in performing each component of CPR, and prior experiences providing or observing CPR (Figure 1). Participants were then instructed to complete a two-minute cycle of monitored adult CPR using bag-valve mask (BVM) for ventilation. We used two ResusciAnne QCPR manikins (Laerdal Medical, Stavanger, Norway) to obtain objective data regarding the parameters of compressions and ventilations delivered including chest compression, hand placement, depth, rate, presence of appropriate recoil, total CPR hands-off time, ventilation success, and ventilatory tidal volume. Following this assessment, participants were given the opportunity to see their individual results and receive feedback from trained AHA instructors observing their performance, if they desired.

Statistical Analysis

Parametric data interpreted on the QCPR manikin SimPad was exported to statistical software for data analysis and are reported with standard deviation. In addition to comparing student CPR performance to published AHA BLS standards, we examined relationships between performance and student gender, prior BLS classes, prior healthcare certifications, prior observations of CPR, and prior experience with CPR. Descriptive statistics, independent t-tests, and one-way analysis of variance (ANOVA) were performed with SPSS version 24.0 (IBM Corporation, Armonk, NY).

RESULTS

A total of 48 fourth-year medical students and 32 first-year PA students participated in the study. The sample demographics and prior healthcare certifications are listed in Table 1. The majority of students (75%) indicated they had attended a BLS course two or more times. When asked about prior BLS experiences in real-life situations, 60% of students reported observing compressions, and 37.5% indicated they had administered compressions themselves. The majority of students agreed or strongly agreed that they felt comfortable performing compressions-based CPR (88%), providing rescue breaths with ventilation (78.8%), and performing CPR with both compressions and ventilations (78.8%).

Outcomes of the two-minute CPR cycle are detailed in Table 2 (compression metrics) and Table 3 (ventilation metrics), along with the corresponding AHA guidelines for each metric measured.

Statistically significant relationships were noted between CPR characteristics and student gender, prior healthcare certifications, attendance of prior BLS classes, and prior CPR experience. Overall, male gender was associated with significantly greater mean compression depth compared to female gender (56.5 millimeters [mm] \pm 6.7 vs 50.3 mm \pm 6.5; $P < 0.001$) as well as maintenance of appropriate depth during

For the following items, please select the one response that is most descriptive of you or fill in the blank as appropriate. If you are not comfortable answering a question, you may leave it blank.

Please choose a 4-digit PIN to serve as your identification for this study. We recommend using the last 4 digits of your cell phone number.

I am a: _____
 First Year (PA-S1) Physician Assistant (PA) Student Fourth Year Medical Student (MS-4)

Age: _____
 18-24 25-29 30-34 35-39 40-44 45 or above

Sex: _____
 Male Female

Race/Ethnicity:
 African American/Black
 Asian/Pacific Islander
 Hispanic/Latino
 Native American/American Indian
 Caucasian/White
 Not Listed (please specify) _____

I have prior healthcare experience involving direct patient contact as a:
 Nurse assistant (CNA)
 Medical assistant (MA)
 Nurse (RN, LPN)
 Respiratory Therapist (RT)
 Emergency Medical Technician (EMT-B, EMT-I, EMT-A, EMT-P)
 Other healthcare experience (please specify) _____
 None of the above

The total number of times I have attended a basic life support (BLS) course (anywhere) is:
 Never
 Once
 Two times
 Three or more times

Prior to taking this course I have:
 Performed chest compressions in a real-life situation
 Observed chest compressions being delivered in a real-life situation
 Neither performed nor observed chest compressions in real life.

I have a physical limitation which may affect my ability to deliver chest compressions:
 No
 Yes, I have the following limitation(s): _____
 Yes, but I prefer not to describe.

Please answer the following questions:

- I feel comfortable performing compression-only CPR
 Strongly Disagree Disagree Neutral Agree Strongly Agree
- I feel comfortable performing rescue breathing with ventilations only
 Strongly Disagree Disagree Neutral Agree Strongly Agree
- I feel comfortable performing CPR with compressions and ventilations
 Strongly Disagree Disagree Neutral Agree Strongly Agree

Figure 1. Pre-assessment Basic Life Support survey of medical students and physician assistant students.

the entire two-minute cycle (82.3% \pm 34.6 of male cycles vs 57.3% \pm 36.2 of female cycles; $P < 0.01$). After further stratifying these data by student type (medical vs PA student), we found that the significant differences in compression metrics between genders was maintained for medical students, but no differences were observed between male and female PA students. No significant differences emerged among the other metrics based on gender.

Students with prior healthcare certifications (Table 1), compared to those without prior certifications, had

Table 1. Participant demographic information.

Characteristics	Medical students, N (%)	Physician assistant students, N (%)	P-value
Age			<0.01
18-24	2 (4.2%)	13 (40.6%)	
25-29	40 (83.3%)	14 (43.8%)	
30-34	6 (12.5%)	3 (9.4%)	
35-39	0 (0%)	1 (3.1%)	
40-44	0 (0%)	1 (3.1%)	
Gender			<0.01
Female	20 (41.7%)	25 (78.1%)	
Male	28 (58.3%)	7 (21.9%)	
Race/ethnicity			0.76
Black	2 (4.2%)	1 (3.1%)	
Asian/Pacific Islander	12 (25.0%)	6 (12.5%)	
Hispanic/Latino	5 (10.4%)	5 (10.4%)	
Native American	1 (2.1%)	0 (0%)	
White	24 (50%)	19 (39.6%)	
Other	4 (8.3%)	1 (2.1%)	
Prior healthcare certification			<0.01
Clinical Nurse Assistant	0 (0%)	10 (31.3%)	
Medical Assistant	1 (2.1%)	2 (6.3%)	
Registered Nurse	0 (0%)	1 (3.1%)	
Emergency Medical Technician	4 (8.3%)	6 (18.8%)	
Other	2 (4.2%)	7 (21.9%)	
None	41 (85.4%)	6 (18.8%)	

significantly higher mean compression rates per minute (149.4 ± 20.0 vs 126.5 ± 18.6 ; $P < 0.001$), less hands-off time (8.4 ± 1.4 seconds vs 9.8 ± 1.9 seconds; $P < 0.01$), higher frequency of correct hand position ($90.7\% \pm 25.8$ vs $73.3\% \pm 37.1$; $P < 0.05$), higher number of CPR cycles completed in five minutes (5.4 ± 0.8 vs 4.4 ± 0.7 ; $P < 0.001$), and higher ventilation mean rate per minute (4.3 ± 1.6 vs 3.2 ± 1.6 ; $P < 0.01$).

Similarly, the number of BLS courses attended in the past was correlated with improved performance on a number of parameters, including compression mean rate ($P < 0.001$), correct hand positioning ($P < 0.05$), ventilation mean volume ($P < 0.01$), and missed ventilations ($P < 0.05$). Subgroup analysis revealed that the positive overall effects of prior BLS attendance were primarily a result of differences seen within the PA student cohort. Furthermore, compression mean rate (P

< 0.05), compression mean depth ($P < 0.05$), maintenance of appropriate depth ($P < 0.01$), total CPR cycles ($P < 0.01$) and number of ventilations given ($P < 0.05$) all were significantly positively correlated with number of prior BLS classes among PA students.

Previous observation of CPR did not correlate with performance; however, provision of real-life CPR did. Specifically, participation in CPR was associated with significant increases in mean compression depth ($56.4 \text{ mm} \pm 6.0$ vs $51.2 \text{ mm} \pm 7.3$; $P < 0.001$) and maintenance of appropriate depth during the entire two-minute cycle ($86.1\% \pm 28.6$ vs $58.4\% \pm 38.4$; $P < 0.001$). No significant differences emerged in the other measures based on CPR participation or observation.

We also compared the performances of medical students and PA students, summarized in Table 2 and Table 3. Medical students were found to compress at a greater mean depth than PA students, whereas PA students compressed at a greater mean rate per minute. PA students exhibited a significantly higher average ventilation rate per two-minute cycle, less hands-off time, higher number of completed CPR cycles, and higher rate of correct hand positioning when compared to medical students. No significant differences between student types were observed in the other parameters measured.

DISCUSSION

Our goal in this study was to investigate the adequacy of CPR training in health professions curricula. We assessed this by measuring the BLS proficiency of medical and PA students immediately following a standard AHA BLS training course. To our knowledge, this is the first study that looks at competency-based skills attainment for BLS in either medical students or PA students immediately following standard BLS training. The results of this study suggest that, despite significant differences in performance found between student types, the current AHA CPR training produces medical and PA students who each are adequate providers of compressions, defined as meeting a majority of AHA guidelines in at least 70% of compression cycles. However, the training did not produce adequate providers of ventilations by this definition. The assessment of specific CPR metrics identified many areas of weakness in performance, indicating students are imperfect when delivering CPR. Therefore, BLS classes for medical and PA students can be improved in order to remedy these deficiencies. We found that previous attendance of BLS courses, having a prior healthcare certification, and prior experience providing compressions on a patient, but not observing compressions, were associated with significantly higher BLS performance. Taken together, our study suggests that AHA BLS courses prepare medical and PA students to adequately deliver quality compressions, but there are opportunities for overall improvement both via training and experiential learning.

Overall, compression rate was satisfactory, with 90% of students maintaining a guideline-adherent rate for the duration of the two-minute cycle. However, despite mean depth of

Table 2. Compression data across student type.

	All students (N=80)	Medical students (N=48)	Physician assistant students (N=32)	AHA guidelines
Mean compression rate (#/minute)	134.5 ± 21.9	121.1 ± 11.7	154.6 ± 17.9**	> 100/minute
Appropriate rate (%/cycle)	90.0 ± 30.2	88.0 ± 33.4	94.0 ± 24.6	100%
Mean compression depth (mm)	53.1 ± 7.2	54.7 ± 6.8	50.8 ± 7.4*	> 50.8 mm
Appropriate depth (%/cycle)	68.8 ± 37.4	74.8 ± 34.9	59.8 ± 39.6	100%
Appropriate recoil (%/cycle)	79.3 ± 24.4	78.0 ± 26.4	81.2 ± 21.4	100%
Hands-off time (sec)	9.3 ± 1.8	10.0 ± 1.8	8.3 ± 1.3**	< 10 seconds
Correct hand position (%/cycle)	79.4 ± 34.4	67.9 ± 38.4	96.6 ± 16.6**	100%
CPR cycles completed (#/cycle)	4.8 ± 0.9	4.2 ± 0.6	5.5 ± 0.6**	5

Note: Bold = comparisons between medical student and physician assistant students are significant at levels: *P < 0.05; **P < 0.001. AHA, American Heart Association; CPR, cardiopulmonary resuscitation; mm, millimeter.

compressions and variations in depth above recommendations, student performance was lacking in maintaining an appropriate compression depth throughout CPR performance. Similarly, inadequate ventilation volume and missed ventilations were common. It is well established that high-quality compressions significantly impact patient outcomes in CPR.¹³ In addition, the ability to ventilate a patient is a critical skill for acute patient deterioration situations, especially when other ancillary staff are unavailable. Thus, focused curriculum reform may be necessary for BLS training programs. It is difficult to assess the reasons why students lacked in performance on certain compression and ventilation measures; however, one potential remedy may be increasing the amount of hands-on time students have with the manikins during BLS training. In addition, studies have demonstrated that using CPR feedback/prompt devices or similar teacher-to-student CPR feedback during hands-on training improves performance.^{14,15} Implementing these strategies during BLS training may, therefore, improve performance among medical and PA students.

Another possibility to improve the current BLS training model may be implementing dyad training, which entails cooperative learning in pairs. Wang et al demonstrated the utility of this model in Advanced Cardiac Life Support (ACLS) training of medical students.¹⁶ Using a dyadic training model during ACLS training resulted in significantly improved resuscitation scores (an overall measure of teamwork), resuscitation skills, and leadership. However, Wang et al did not report specifically whether this method improved exact compression and ventilation parameters. For BLS training, implementing a dyadic model may involve splitting students into pairs and alternating between each individual on simulated

practice, followed by shared discussion. Further studies are warranted to explore whether such a change in training design can improve medical and PA student BLS performance.

Training of medical and PA students in BLS may also benefit from distributed practice of CPR. Lin et al studied the effects of such practice among pediatric healthcare providers.¹⁵ Practicing CPR for two minutes on manikins at least once per month, in combination with real-time feedback, resulted in significantly improved adult and infant CPR quality across a vast majority of CPR parameters compared to those who did not practice CPR. This improved performance lasted throughout the 12-month study period. Similarly, Nishiyama et al found that a 15-minute refresher BLS training of medical students resulted in significant improvement in certain compression proficiency measurements, up to one year after the refresher.¹⁷ This is consistent with the findings of our study that prior BLS course attendance was significantly associated with improved CPR performance. Overall, this suggests that, although medical and PA students are imperfect CPR providers immediately after BLS training, their skills may improve with deliberate, frequent practice. Such practice may be implemented into the normal clinical instruction of these students to ensure regularity and adherence.

Another potential source of active BLS skills practice for medical and PA students may be actively involving students during patient resuscitations they encounter naturally in their clinical duties. Our study found that a majority of students had observed compressions being delivered to a patient, but only 37.5% had administered compressions themselves. Furthermore, experience delivering compressions on a patient in the past as well as having a prior healthcare certification

Table 3. Ventilation data across student type.

	All students (N=80)	Medical students (N=48)	Physician assistant students (N=32)	AHA guidelines
Ventilation mean volume (mL)	458.5 ± 161.9	451.8 ± 176.0	468.5 ± 142.2	450 – 550 mL
Excessive ventilation (%/cycle)	12.2 ± 22.1	12.1 ± 22.9	12.4 ± 21.1	0%
Appropriateness of ventilation (%/cycle)	44.3 ± 31.9	40.9 ± 34.0	49.3 ± 28.1	100%
Inadequate ventilation (%/cycle)	41.0 ± 35.2	42.8 ± 38.5	38.3 ± 30.0	0%
Ventilation mean rate (#/min)	3.5 ± 1.7	3.0 ± 1.5	4.4 ± 1.5**	5/min
Missed Ventilations	2.2 ± 2.4	2.4 ± 2.5	1.8 ± 2.2	0

Note: Bold = comparisons between medical student and physician assistant students are significant at levels: *P < 0.05; **P < 0.001. AHA, American Heart Association; mL, milliliter; min, minute.

significantly correlated with higher performance in multiple measures of compression adequacy; however, prior experience only observing compressions did not. Together, this suggests that involving students in real-life hands-on experiences, such as actual resuscitations, improves their CPR performance over time, but a majority of students do not get this opportunity.

Unfortunately, given that this study demonstrated that student performance lacks in multiple CPR parameters immediately after BLS training, simply allowing students to perform CPR on arrested patients without ensuring BLS excellence may risk patient outcomes. Furthermore, even if students were allowed to administer CPR, in a previous study our group found that >35% of fourth-year medical students were reluctant to participate in resuscitations, as they felt unprepared. Training programs would be wise to adopt competency-based assessments along with regular practice to ensure proficiency and preparation in these areas rather than relying on certifications after training courses. This is especially salient given we found that a vast majority of students in our study self-reported confidence in their CPR skills.

Finally, we did not explore how BLS skills among medical and PA students change over time after the immediate period following BLS training. Previous studies have demonstrated that after training, self-reported confidence in BLS skills and proficiency in BLS skills decline.¹ As discussed above, regular practice may be necessary for students to not only retain BLS skills, but also improve upon them. Longitudinal investigations of multiple cohorts of medical and PA students in a controlled, experimental setting are needed to help elucidate changes in BLS skills over time and how skill decay can be counteracted.

LIMITATIONS

Although this study reports granular data on the ability of first-year PA students and fourth-year medical students

to perform CPR-related skills following BLS training, there are a number of limitations. First, these data represent only a snapshot of performance in a simulated setting. It is unknown how students would perform in each of these areas in the face of a true clinical scenario. Along similar lines, some useful metrics, such as chest rise and fall and patient-centered outcomes, were not measured in the study. The baseline BLS skill competence of students was not measured prior to the BLS course, so it is difficult to assess whether students significantly improved in skills after taking the course. However, this is a minor limitation, as the goal of the study was to evaluate whether students are competent up to BLS guidelines following AHA BLS training in the health curricula, not whether there is a significant improvement from baseline. The impact of feedback and reassessment on student performance was not measured, either. Additionally, this study was conducted at a single US medical/health professions school; complicating this, selection bias may have skewed the data, as these results capture data from a convenience sample of trainees who volunteered to be included after participating in a standardized AHA BLS course.

CONCLUSION

The current AHA BLS training provided to fourth-year medical students and first-year PA students produces providers who are capable of delivering compressions in an AHA guideline-adherent manner for the majority of a two-minute CPR cycle. However, inadequate performance in certain compression and many ventilation measurements demonstrate areas of improvement for BLS training programs. Previous attendance of BLS trainings, prior healthcare certification, and prior real-life experience in administering CPR were found to be predictive of student BLS competency, but previous experience simply observing CPR being performed was not.

Address for Correspondence: M. Tyson Pillow, MD, Med, Baylor College of Medicine, Department of Emergency Medicine, One Baylor Plaza, Houston, TX 77030. Email: pillow@bcm.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Virtual Book Club for Professional Development in Emergency Medicine

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Chase E. Richard, MD, MBA
Stephen Villa, MD
Natasha Wheaton, MD

University of California, Los Angeles, David Geffen School of Medicine, Department of
Emergency Medicine, Los Angeles, California

Section Editor: Andrew Phillips, MD

Submission history: Submitted July 14, 2020; Revision received November 14, 2020; Accepted November 22, 2020

Electronically published December 14, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.49066

Introduction: Professional development is an important component of graduate medical education, but it is unclear how to best deliver this instruction. Book clubs have been used outside of medicine as a professional development tool. We sought to create and evaluate a virtual professional development book club for emergency medicine interns.

Methods: We designed and implemented a virtual professional development book club during intern orientation. Afterward, participants completed an evaluative survey consisting of Likert and free-response items. Descriptive statistics were reported. We analyzed free-response data using a thematic approach.

Results: Of 15 interns who participated in the book club, 12 (80%) completed the evaluative survey. Most (10/12; 83.3%) agreed or strongly agreed that the book club showed them the importance of professional development as a component of residency training and helped them reflect on their own professional (11/12; 91.7%) and personal development (11/12; 91.7%). Participants felt the book club contributed to bonding with their peers (9/12; 75%) and engagement with the residency program (9/12; 75%). Our qualitative analysis revealed five major themes regarding how the book club contributed to professional and personal development: alignment with developmental stage; deliberate practice; self-reflection; strategies to address challenges; and communication skills.

Conclusion: A virtual book club was feasible to implement. Participants identified multiple ways the book club positively contributed to their professional development. These results may inform the development of other book clubs in graduate medical education. [West J Emerg Med. 2021;22(1)108-114.]

BACKGROUND

Professional development, defined by the US Centers for Disease Control and Prevention as “a systematic process that strengthens how professionals obtain and retain knowledge, skills and attitudes,” is essential for trainees in order to meet the challenges of medical practice and develop into physician leaders.¹ Professional development can help engage trainees in reflective and deliberate practice, allowing them to be better prepared for their future careers.² It also serves to encourage

the growth of physician advocates and leaders to meet the ever-changing, complex needs of the field of medicine.³ These demands require physicians to be capable of conducting self-directed development of their clinical competency, interpersonal dynamics, and overall professionalism. By improving engagement and continuing to develop the skill set required to meet the challenges of medical practice, professional development can help mitigate burnout and has been identified as a strategy for resilience in medicine.^{4,5}

Similarly, personal development is also a lifelong learning process that incorporates self-reflection and external feedback to promote awareness of identity, achievement of goals, and enhanced quality of life.⁶ Personal and professional development are often intertwined in medicine, and both are important for medical trainees.⁶⁻¹⁰ The importance of professional development in emergency medicine (EM) residency education is supported by the regulatory requirements of the Accreditation Council for Graduate Medical Education (ACGME).¹¹

Professional and personal development are complex constructs with little data to guide optimal teaching modalities. However, randomized controlled trials have revealed that teachers who received direct developmental interventions received higher overall teaching quality scores.¹² Professional development opportunities abound in other business sectors using a wide spectrum of experiences, varying from online forums and longitudinal courses to conferences, mentoring groups, and case studies as well as book clubs.¹³⁻¹⁴ Book clubs have been used in other industries including business and teaching as a professional development tool that encourages active engagement, self-reflection, and team building.¹⁵⁻¹⁶

Book clubs have also been used for longitudinal professional development in other allied health professions and as a way to improve interprofessional communication, leadership skills, and learner's understanding of the patient perspective.¹⁷⁻²² However, there is limited literature regarding the use of book clubs in graduate medical education (GME).^{21, 23-24} The literature that does exist primarily consists of curricular descriptions and limited outcome data, which have generally been positive.^{21, 23-24} As an example, Kan et al describe a book club for psychiatric trainees consisting of 90-minute, bimonthly sessions incorporating trainee led, instructor facilitated, in-depth discussions of nonfiction book content and application to psychiatric and clinical practice, which was felt by participants to positively contribute to training.²³

OBJECTIVES

The emergence of the COVID-19 pandemic has led to the transition of many medical education experiences to the virtual environment.²⁵ This transition has created an opportunity for educators to develop remote learning methods to ensure high quality education at the GME level.²⁶⁻²⁷ To meet the demands of professional development education in a virtual setting we sought to create and evaluate a virtual professional development book club for EM interns. The goals of the book club were as follows: 1) to introduce residents to the importance of personal and professional development as a component of residency training; 2) to encourage the use of personal and professional development materials outside of medicine; and 3) to foster a culture of metacognition.

CURRICULAR DESIGN

Our study team of medical educators designed the book club with input from our resident team member. We

Population Health Research Capsule

What do we already know about this issue?
Professional development is an important component of graduate medical education, but it is unclear how to best deliver this instruction.

What was the research question?
Can a virtual professional development book club be successfully implemented for EM interns?

What was the major finding of the study?
A virtual professional development book club was feasible to implement and perceived to be valuable.

How does this improve population health?
These results may inform the development of other book clubs in graduate medical education.

purposefully identified a broad range of books that addressed professional development topics based on national bestseller lists, book reviews, and the authors' prior experiences with other professional development book clubs. We selected the final list of five books by group consensus (Appendix A). We chose to allow learners to select a book from our suggested list to augment learner agency and engagement. The use of multiple books also allowed the group to learn from each other as each book was discussed during the session. We planned the book club to be conducted over two hours and include an introduction, small-group breakout discussions on individual books, report out in a large group discussion, and summary and reflection of impact on learners as physicians and trainees. The book club director (NW) created the discussion questions based on the goals of the sessions with input from the study team. Open-ended questions were used to maximize depth of response and promote discussion. Discussion questions are available in Appendix B.

We contacted all 15 incoming EM interns one month prior to intern orientation and invited them to participate in the book club. In an effort to promote self-reflection and inquiry, we provided them the book list with a short description of each book and asked that they rank their book preferences. To ensure equal distribution of books, the book club director then assigned participants a book according to their preferences. All participants received their first or second

professional (11/12; 91.7%) and personal development (11/12; 91.7%). Participants also noted that the book club contributed to bonding with their peers (9/12; 75%) and engagement with the residency program (9/12; 75%). Two thirds of participants said they would like to participate in additional book clubs during residency. A minority (5/12; 41.7%) of participants planned to read another professional development book in the next 12 months.

Results of qualitative analysis are displayed in Table 2. Our qualitative analysis revealed five major themes regarding how the book club contributed to professional and personal development: alignment with developmental stage; deliberate practice; self-reflection; strategies to address challenges; and communication skills. Participants noted that the book club was also valuable in helping them engage with the program’s faculty and residents. Participants noted they planned to directly apply content discussed in the session. For example, related to the discussion on growth mindset, one participant remarked, “[I plan to] have a positive outlook and prepare to learn and grow throughout residency.” The one theme that emerged for improvement of the book club was the suggestion to hold it in an in-person setting.

GME training programs in EM require learners to simultaneously learn the core content of EM as well as develop the personal and professional skills necessary to safely navigate the multifaceted milieu of the emergency department (ED), an environment with multiple types of workers including nurses, technicians, clerical staff, and physician colleagues. Emergency physicians must develop robust professional skills to effectively interact with and lead multidisciplinary teams as well as to mitigate such factors as burnout in order to sustain a successful career in medicine. As opposed to procedural skills, medical knowledge, and concrete aspects of patient care, professionalism and communication-

based competencies are relatively intangible and difficult to “teach.”

A professional development book club such as the one developed and evaluated in this study provides a potential strategy for developing these skills. While there is literature describing the importance of humanities in medical education and utilization of a book club experience in GME programs, we believe this is the first such experience to incorporate professional development books as the substrate for learning and discussion.^{23,31,32} Our results demonstrate that this type of educational offering was feasible to implement, well received by trainees, and has the potential to support trainees in self-reflection, deliberate practice, communication, and addressing challenges. Additionally, while we did not directly measure metacognition, the free-response data from participants indicated metacognitive activities such as planning an approach to learning, self-assessment and correction, and using appropriate strategies to solve a problem.

Participants felt this book club positively contributed to their professional development in several ways including the encouragement of deliberate practice, which has been identified in the literature as a key component in the development of expertise.³³⁻³⁵ Fostering this practice early in training may compound results. Participants also noted the book club promoted self-reflection, which has been described as being essential for improvement.³⁶⁻³⁷ Additionally, participants felt this session contributed to their development by introducing specific, actionable strategies to address challenges and build communication skills. The strategies introduced may be particularly beneficial in the ED where the ability to handle the unpredictability and critical nature of disease presentations, endure frequent interruptions, manage conflict, and use a team approach to patient care is crucial.³⁸⁻⁴² Finally, both quantitative and qualitative results demonstrate that participants viewed

Table 1. Participant perspectives of virtual book club.

	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Total n (%)
This book club showed me the importance of professional development as a component of residency training.	0 (0)	0 (0)	2 (16.7)	7 (58.3)	3 (25.0)	12 (100%)
This book club helped me reflect on my own professional development.	0 (0)	1 (8.3)	0 (0)	9 (75.0)	2 (16.7)	12 (100%)
This book club helped me reflect on my own personal development.	0 (0)	1 (8.3)	0 (0)	8 (66.7)	3 (25.0)	12 (100%)
I plan to read another professional development book in the next 12 months.	1 (8.3)	4 (33.3)	2 (16.7)	4 (33.3)	1 (8.3)	12 (100%)
This book club contributed to bonding with my peers.	0 (0)	1 (8.3)	2 (16.7)	7 (58.3)	2 (16.7)	12 (100%)
This book club facilitated my engagement with the residency program.	0 (0)	0 (0)	3 (25.0)	6 (50.0)	3 (25.0)	12 (100%)
I would like to participate in additional book clubs during residency.	1 (8.3)	0 (0)	3 (25.0)	6 (50.0)	2 (16.7)	12 (100%)

this experience as an opportunity to engage with faculty and peers. Holding such an event early in training may help to more effectively and efficiently integrate new interns into the residency program. Forming bonds with faculty and peers can enable a strong support network and foster community, which can decrease burnout.⁴³⁻⁴⁵

The majority of participants felt that the session helped them think about how to deploy new professional skills as they entered into residency training. Given the perceived utility of the exercise, it was surprising that fewer than half of the cohort indicated that they planned to read another personal or professional development book in the coming 12 months. This most likely reflects their preconceived thoughts that they will need to spend what little time they have as interns reading medical content rather than professional development books. This finding emphasizes that the period of time prior to starting clinical rotations was the ideal time to hold this exercise in order to introduce the importance of professional development on EM practice. It may also be beneficial to incorporate such a session during the final months of medical school when student responsibilities have waned, as a deliberate attempt to jump start their subsequent postgraduate development.

We believe that it is our role as educators to ensure that our trainees are receiving a comprehensive medical education including EM core content and professional development.

Deliberate attempts by program leadership to incorporate professional development into the curriculum may be necessary to ensure that these important topics are addressed. The majority of participants reported that they would like to participate in additional book clubs during residency. An in-person setting was recommended for improvement, which likely reflects the less personal nature of the virtual environment. Although the book club experience would likely have been richer as an in-person event, the participants' experiences with this version showed that value was maintained using a virtual platform.

We developed this book club as a novel experience to encourage our interns to embark on a path of personal and professional development from the very beginning of residency training. We also hope this experience fosters an awareness of the opportunities to develop these less tangible skills in the clinical environment, as well as the benefit of reaching outside of the medical sphere for expertise in skill development. It is our hope that an increased knowledge of variances in mindset, learning style, negotiation tactics, and communication skills will allow our interns to observe, reflect on, and model others' behaviors as they progress through their training. In the future we plan to evaluate objective learning outcomes, as these were not assessed in the current study, and to expand the scope of a professional development-themed book club.

Table 2. Results of qualitative analysis of interns' perceptions regarding the use of a virtual book club for professional development.

Domain	Major themes	Exemplar quotes
Contribution to professional and personal development	Alignment with developmental stage	"This book was appropriate for someone about to start residency."
	Deliberate practice	"Applying a more intentional perspective towards learning in a meaningful manner in residency."
	Self-reflection	"...thinking more about how to organize my goals in relation to my overall purpose. I believe this will be helpful in terms of prioritizing where I direct my energy."
		"Insight into how my professional development has been influenced by my personal characteristics."
Additional value of book club	Strategies to address challenges	"It helped me reflect on my own tendencies in difficult interactions and how those can be improved."
	Communication skills	"The book made me reflect on how to deal with challenges in life and how to persist and use the opportunity to grow."
	Opportunity to engage with program faculty	"[This book club] improved my communication skills."
Plans for change after book club	Opportunity to engage with program residents	"I enjoyed getting to know the faculty better in small groups."
	Direct application of discussed content	"I appreciated participating with my peers."
Improvement of book club	In-person setting	"I will try and take a step back and remove my emotion from the situation when faced with a difficult interaction." "I think this was a great idea, however, I think this would be much better in person."

LIMITATIONS

There are several limitations that must be considered. This study was conducted at a single academic institution so the results may not be generalizable. Additionally, the sample size was small and only consisted of interns; thus, it is unclear whether these same results would be found across postgraduate year levels. We believe these limitations are acceptable as an initial assessment of a novel educational session. Although the response rate was good, it is possible that non-responders may have answered differently than those who completed the evaluative survey. Additionally, while the survey was confidential and it was explicitly communicated to participants that we were interested in honest and candid feedback as this was a new educational session, there is the possibility of response bias. Finally, based upon feedback, holding this session in person may have been beneficial and it is unclear how the setting influenced the impact of the book club.

CONCLUSION

In summary, a virtual book club was feasible to implement and participants perceived positive contributions to their professional development. Potential positive outcomes include encouragement of deliberate practice and self-reflection, improved communication skills and strategies to address challenges, and engagement with each other as well as residency program leadership. These results may inform the development of other book clubs in graduate medical education.

Address for Correspondence: Jaime Jordan, MD, UCLA David Geffen School of Medicine, Department of Emergency Medicine, 924 Westwood Boulevard, Suite 300, Los Angeles, CA 90024. Email: JMJordan@mednet.ucla.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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COVID-19 Conferences: Resident Perceptions of Online Synchronous Learning Environments

William Weber, MD, MPH
James Ahn, MD, MHPE

The University of Chicago, Section of Emergency Medicine, Chicago, Illinois

Section Editors: Danielle Hart, MD, MACM

Submission history: Submitted July 15, 2020; Revision received November 22, 2020; Accepted November 23, 2020

Electronically published December 14, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.49125

Introduction: The coronavirus disease 2019 pandemic forced a rapid transition of in-class residency conferences to online residency conferences; little is known about learners' perceptions of this new didactic environment. Understanding learners' perceptions of virtual classrooms can help inform current and future best practices for online, synchronous, graduate medical education.

Methods: We surveyed emergency medicine and internal medicine residency programs at a large urban academic medical center about their perceptions of synchronous online residency conferences.

Results: Residents reported a preference for in-class interactions with peers (85%) and lecturers (80%), with 62% reporting decreased levels of engagement with lecturers during online conferences. Residents reported performing nearly twice as many non-conference-related activities (eg, email, exercise) during online conferences vs in-class conferences. Residents felt that the following methods improved engagement during online conferences: lecturers answering chat questions; small group sessions; and gamification of lectures.

Conclusion: Synchronous online residency conferences were associated with decreased engagement and attention by learners. Simple methods to increase interactivity may help improve the online classroom experience and cultivate novel teaching environments that better support current learning styles. [West J Emerg Med. 2021;22(1)115-118.]

INTRODUCTION

Postgraduate physician trainees (residents) complete weekly didactic sessions (conferences) as required by the Accreditation Council for Graduate Medical Education (ACGME).¹ These conferences traditionally take place in a classroom setting. The SARS-COV-2 coronavirus (COVID-19) pandemic has forced rapid changes to graduate medical education (GME). In the interest of infection control during COVID-19, many residency programs have limited the number of congregating individuals, meaning that in-person lectures have transitioned to synchronous, online learning formats. Such educational environments typically involve learners logging into an online group meeting platform that allows for sharing of presentations as well as discussion over video.

While technology exists for online synchronous resident conferences, such conferences have been common practice for

only a small minority of residencies and there is a paucity of research about resident learner perceptions. A meta-analysis of internet-based learning in the health professions in 2008 found similar learner satisfaction and perceived knowledge and skills obtained through online learning; however, less than 10% of the analyzed studies involved synchronous online learning and less than 20% involved residents.² A meta-analysis of instructional design in internet-based learning in health professions was unable to make strong recommendations for practice but identified themes such as interactivity and practice exercises as potential areas of further research.³ Many of these themes stem from social learning theory, which has been used as a framework for studying web-based learning environments. Effective web-based learning generally provides learners meaningful interactions with their professors and peers, fosters a culture of learning, and supports multiple learning styles.⁴

Within postgraduate medical education, a recent study of internal medicine program directors found that only 40% of programs had tried synchronous conferences in the past, with less than 20% using synchronous conferences either “often” or “somewhat often.”⁵ The Council of Residency Directors in Emergency Medicine has acknowledged that synchronous online didactics can fulfill educational requirements.¹ Some residency programs have adopted an asynchronous component to conferences, such as incorporating online learning resources to study, but minimal literature exists on the perceptions of emergency medicine (EM) and internal medicine (IM) residents with synchronous online curricula.

METHODS

EM and IM residency programs at the University of Chicago were invited to participate in an 11-question survey through established email lists. Survey validity was established by an iterative review process by EM medical education faculty followed by revision and piloting with a representative audience of GME learners from other local institutions. We reviewed feedback from the pilot and incorporated it into the final survey. The survey included an evaluation of learner perceptions of effectiveness of didactic sessions, engagement with lectures, attention to lectures, and performance of simultaneous activities. Residents who completed the survey were invited to enter a drawing for \$5 gift cards.

We tabulated and analyzed survey results using Microsoft Excel (Microsoft Corporation, Redmond, WA). The study used two-sample t-tests with an alpha level of <0.01 for significance

with a Bonferroni adjustment. For questions with ranges (eg, 0-20% or 1-2 times per hour), we used the average of the range to code the data. The study was approved by the University of Chicago Institutional Review Board: IRB20-0851.

RESULTS

A total of 81 residents (54% female) participated in the survey: 31 of a possible 49 (63%) EM residents and 50 of a possible 112 (45%) IM residents. The respondents were distributed by postgraduate year (PGY) with 33% PGY 1, 42% PGY 2, and 25% PGY 3 or greater.⁵ The University of Chicago has three-year IM and EM programs, but IM includes a small number of dual-residency IM / pediatrics residents whose training extends further.

Online conferences had varying degrees of perceived effectiveness. Learners felt that standard lectures translated most easily from an in-class to online format, with a near-even split of those preferring in-class (38%), online (38%), and feeling that the two formats were equivalent in effectiveness (31%) (Figure 1). Learners preferred an in-class setting for interactive lectures, such as game show or question-based formats (58%), with fewer learners preferring online (20%) or feeling equivalence between the settings (22%).

Learners felt that in-class lectures provided more effective engagement with both presenters (80%) and peers (85%) (Figure 1). The majority of learners (62%) reported interacting with presenters less often during online lectures, with a small proportion of students reporting no change (23%) or increased frequency (15%) of interaction during online lectures. In

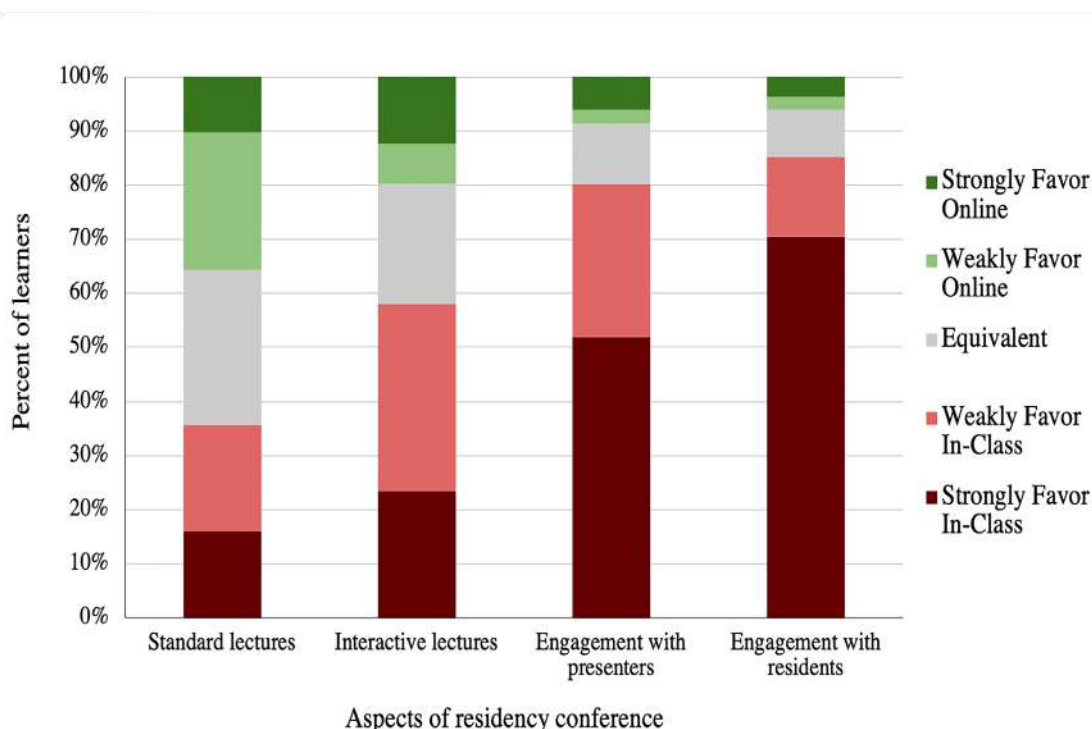


Figure 1. Comparison of perceived effectiveness in aspects of online and in-class residency conferences.

terms of techniques that helped learners engage with a lecturer online, residents felt that a lecturer answering chat questions was most engaging (40%), followed by small-group breakout rooms (21%), and gamification of lectures (audience answering questions for points or prizes) (20%).

Learners reported decreased attention during online conferences (65%) as compared with in-class conferences. When exploring the reasons for decreased attention, learners reported engaging in other activities simultaneously with online conferences. Learners reported a statistically significant increase in frequency of researching conference-related materials, visiting websites not related to conference, reading or composing emails, and completing daily tasks such as exercise or washing dishes (Table 1). In total, learners participated in nearly twice as many non-conference related activities per hour during online conference (4.6 per hour) than during in-class conference (2.4 per hour).

When comparing residency programs on the number and type of simultaneous activities completed during conference, we found no significant differences between EM and IM learners. When given the choice of what percentage of conferences to keep online vs in-class post-COVID-19, residents wanted an average of 42% of conferences online and 58% in-class.

DISCUSSION

The rapid transition of residency conferences from an in-class to online format during COVID-19 led to a perceived decrease in engagement from learners. While learners felt that lecture-based formats were similar in their effectiveness, they felt that their interactions with both peers and lecturers were not as effective. Social learning theory suggests that peer interaction plays an important role in online learning success.⁵ For instance, attentive classmates model good behavior for a learner and create a positive learning culture. During “screen sharing” presentations, learners may miss body language cues from both the lecturer and their classmates.

Learners suggested multiple techniques that could improve engagement. The top-rated method to increase engagement involved speakers interacting with learners through answering questions from the group chat, consistent with tenets of social learning theory.⁴ A lecturer’s responsiveness to the audience

may help participants avoid the feeling of watching a video by allowing them to shape lecture content, consistent with Cook’s suggestion that interactivity promotes learning.³ Learners also appreciated small-group breakout sessions and gamification of lectures. All of these techniques support active learning and help overcome the passivity of sitting behind a computer screen.

A majority of learners noted decreased attention with online conferences; this was accompanied by an increase in performing other activities simultaneously with conferences. Residents reported completing nearly twice as many non-conference related activities per hour during online conference than during in-class conference. This increase in potentially distracting activities could lead to residents missing important learning points.

Improving attention could involve structural adjustments as well as a reframing of the conference dynamic. Policies such as keeping webcams enabled could help provide visual feedback to presenters if learners are distracted. The aforementioned methods of creating an interactive synchronous online environment can help focus learner attention. However, an online synchronous classroom setting invites reconsideration of learner behavior. Students in the online environment reported a higher frequency of researching conference-related topics, which provided learners a deeper exploration of conference material in real time. Modifications of the online learning environment to embrace certain benefits of the online format, such as quick breakout rooms, could support diverse learning styles while minimizing unhelpful distractions. While learners reported an increase in simultaneous activities, perhaps not all activities are detrimental to attentiveness. Multiple residents noted that “doing dishes” or “light exercise” allowed them to stay focused for longer periods of time, suggesting that certain simultaneous activities might improve attention for some learners.

LIMITATIONS

This study took place at a single academic medical center, where local practices or conference formats may differ from other locations. However, the ACGME standards for didactic lectures and the COVID-19 pandemic have forced many institutions to transition to online conference. Response bias is always a possibility, especially when just over half of eligible

Table 1. Average frequency of resident learners engaging in other tasks simultaneously with residency conferences.

	In-class mean (times/hour)	Online mean (times/hour)	Mean difference (times/hour), [99% CI]
Researching conference-related materials	0.96	1.45	0.49 [0.35, 0.63]*
Browsing non-conference websites	1.01	1.64	0.63 [0.49, 0.77]*
Emailing	1.05	1.64	0.59 [0.46, 0.72]*
Daily tasks (eg, workout)	0.39	1.40	1.01 [0.90, 1.12]*

*Significant at alpha <0.01. All confidence intervals include a Bonferroni correction. CI, confidence interval.

residents participated in the survey. Finally, the study relied on self-reported attention and effectiveness of learners, which might not accurately capture learner behavior. While the rapidity of COVID-19 social distancing measures prevented pre-pandemic measures of outcomes data, further study could explore learning outcomes and compare current data on online, synchronous conferences with data collected if and when institutions return to in-person conference settings.

CONCLUSION

The rapid transition from in-class residency conferences to online conferences during the COVID-19 pandemic led to a reported decrease in engagement and attention of learners. Residents also reported increased frequency of multitasking during online conferences, performing nearly twice as many tasks unrelated to conference. Adjustments such as lecturers answering chat questions, small group sessions, and gamification are associated with learners feeling more engaged, aligning with tenets of social learning theory.

Address for Correspondence: William Weber, MD, MPH, The University of Chicago, Section of Emergency Medicine, 5841 S. Maryland Avenue - MC5068, Chicago, IL 60637. Email: wweber@medicine.bsd.uchicago.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Global Emergency Medicine Fellowships: Survey of Curricula and Pre-Fellowship Experiences

Elise Klesick, DO
Wael Hakmeh, DO

Western Michigan University School of Medicine, Department of Emergency Medicine,
Kalamazoo, Michigan

Section Editor: Danielle Hart, MD, MACM

Submission history: Submitted July 9, 2020; Revision received November 25, 2020; Accepted November 26, 2020

Electronically published December 19, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.11.49008

Introduction: Lack of accreditation requirements affords global emergency medicine (GEM) fellowships the flexibility to customize curricula and content. A paucity of literature exists describing the state of GEM fellowship programs. We describe the current state of GEM fellowship curricula including which components are commonly included, and highlighting areas of higher variability.

Methods: We identified GEM fellowships and invited them to participate in a web-based survey. Descriptive statistical analysis was performed.

Results: Of the 46 fellowship programs invited to participate, 24 responded; one duplicate response and one subspecialty program were excluded. The 22 remaining programs were included in the analysis. Nineteen programs (86%) offer a Masters in Public Health (MPH) and 36% require an MPH to graduate. Additionally, 13 programs (59%) offered graduate degrees other than MPH. Fellows average 61 clinical hours per month (95% confidence interval, 53-68). Time spent overseas varies widely, with the minimum required time ranging from 2-28 weeks (median 8 weeks; interquartile range [IQR] 6,16) over the course of the fellowship. The majority of programs offer courses in tropical medicine (range 2-24 weeks, median 4 weeks) and the Health Emergencies in Large Populations course. Only 32% of programs reported offering formal ultrasound training. Fellows averaged 1.3 research projects prior to fellowship and median of 2.5 during fellowship (IQR 1,3). While the majority of GEM fellowship graduates worked at US academic centers (59%), 24% worked in US community hospitals, 9% worked for non-profit organizations, and 9% worked internationally in clinical practice.

Conclusion: Our results highlight the wide variability of curricular content and experiences offered by GEM fellowships. [West J Emerg Med. 2021;22(1)119-123.]

INTRODUCTION

Background

Global emergency medicine (GEM) is a broad and growing subspecialty within emergency medicine (EM). GEM is a diverse field that includes clinicians involved in tropical medicine, trauma, disaster response, and epidemiology, as well as researchers, public health experts, and professionals working to improve global health systems and policies. Many GEM clinicians are also involved in training physicians and other providers to advance EM in other countries.¹ The number of GEM fellowships has greatly increased over the past 20 years. A survey in the early 2000s identified eight such fellowships, yet the

Society for Academic Emergency Medicine (SAEM) currently lists 42 global international EM fellowships.^{2,3} Because GEM fellowships are not accredited by bodies such as the Accreditation Council for Graduate Medical Education (ACGME), programs have the ability to customize curricula based on each fellowship's resources, geographic advantages or limitations, and connections with international colleagues and nonprofit organizations. Little is currently known about the diversity and variation currently present among GEM curricula.

Importance

In the 1990s, as EM continued to grow as a specialty

internationally, fellowship training was identified as a means of equipping physicians to help develop EM residency programs overseas.⁴ Multiple models for GEM fellowship curricula have been proposed and tested since then,^{5,6} including a basic curricular framework that features seven core topics. Beran et al. describe how one fellowship used the seven core curricular elements model to redesign its program.⁷

By the early 2000s, there were eight GEM fellowships.² All offered MPH degrees and offered fellows a variety of opportunities to travel and develop academic projects. Fellowship graduates were found to work primarily in academic settings, although all graduates reported continued involvement in international health.² In 2011, GEM fellowships were surveyed and graded on how well each program covered six topics of interest.⁸ The study did not delve into what experiences fellows can expect, and curricula are likely to have evolved in the years since.

While there are a number of fellowship programs providing additional training to emergency physicians interested in global health, GEM is currently not an accredited subspecialty. Although lack of accreditation requirements provides programs flexibility in what experiences they can offer, it also means that there is no standardized core curriculum across all fellowships. There is a paucity of available literature describing expectations of GEM fellows before, during, and after fellowship.

Goals of This Investigation

The purpose of this study was to describe the current curricula and experiences offered by GEM fellowship programs, identify what experiences are common or expected prior to GEM fellowship, and describe what careers graduates of these fellowships ultimately pursue.

METHODS

Study Design and Population

We used a cross-sectional survey of GEM fellowships. We developed the online survey using a nominal group technique with the following goals: 1) describe GEM fellowship curricula and experiences offered by GEM fellowship programs; 2) identify which experiences are common or expected prior to GEM fellowship; and 3) describe the career paths that GEM fellows pursue immediately post graduation. The survey was initially piloted on five emergency physicians (a department chair, a fellowship director, and three residents) and revised based on their feedback. The survey was converted into an electronic format on a university online platform. This research was approved by the applicable institutional review board.

We identified GEM programs using two publicly available databases,^{3,9} and additional programs were identified by internet searches and word of mouth. Additional identified programs were added until three weeks before the end of data collection.^{9,10} For a program to be included, fellowships had to accept EM residency graduates, be run either by a department of EM or have a track specifically designed for EM residency graduates,

Population Health Research Capsule

What do we already know about this issue?
Global emergency medicine (GEM) fellowships are not currently accredited, which allows variations in curricula. A survey in the early 2000s revealed all GEM fellowships offered a MPH, but curricula were otherwise diverse.

What was the research question?
What is the current status of GEM fellowships, including fellowship curricula, and pre- and post-fellowship experiences?

What was the major finding of the study?
All responding programs offer a masters degree and time to work overseas. The remainder of fellowship experiences are variable.

How does this improve population health?
This study informs physicians considering GEM fellowship of the diversity in curricula. Applicants are empowered to find the program and curricula that best support their career goals.

and the program had to be either currently active or active within the past three years. Programs were considered inactive and hence excluded if 1) the listed program director or coordinator reported via direct communication with us that the program was inactive, or 2) the institution did not have a webpage for the GEM fellowship and did not list the fellowship on its online list of fellowships offered. We excluded programs if they focused primarily on a specific niche within GEM (eg, pediatric GEM, or toxicology). Consent was obtained from all participants at the beginning of the survey.

Survey Content and Administration

The survey included multiple choice and free-text responses. Programs were asked demographic questions including number of fellows accepted annually, and length of fellowship. Participants were asked to disclose which advanced degrees were offered, and whether or not specific courses and training programs were included in fellowship curriculum. Participants were then asked to identify how many fellowship graduates went on to work in various settings.

We collected data between January–April 2019. Eligible program directors and coordinators were emailed invitations to participate along with a survey link. Nonresponders were sent reminder emails weekly for two weeks. A final personalized email invitation was sent to directors of nonresponding programs prior to terminating data collection. Due to difficulty

ascertaining how many programs were active, nonresponding programs were contacted by email or phone. Programs were asked if they were still active, and if they had a fellow in the 2019-2020 academic year. We collected and managed survey responses using RedCap (Vanderbilt University, Nashville, TN) and sent them in aggregate to investigators with personal identifiers removed to maintain anonymity.

Data Analysis

We performed descriptive analysis using SAS v9.4 (SAS Institute, Cary, NC). Categorical responses were reported as frequency (percentage), and numerical responses were reported as mean (standard deviation [SD]) or mean (interquartile range [IQR]).

RESULTS

We identified 57 GEM programs, of which 11 were excluded. (See Figure 1 for more details.) Seven programs were initially excluded due to being clearly inactive and therefore not meeting inclusion criteria. Three programs were excluded due to lack of an email address for a program director or coordinator. One program was excluded for having too narrow a focus (toxicology).

Ultimately, survey invitations were distributed to 67 fellowship directors and coordinators representing 46 programs; many programs listed only one contact person. Surveys were completed by 24 participants representing 23 fellowship programs. One response was omitted due to two responses from the same fellowship. (The response from the program coordinator was disregarded in favor of one completed by the program director.) An additional survey response was omitted due to the fellowship not meeting inclusion criteria (the fellowship was later found to be centered on pediatric EM). We included in the analysis results from the remaining 22 surveys.

There was difficulty in ascertaining which programs were

definitely inactive. A total of 37 programs confirmed via phone or email that they were active. Three emails and three phone calls on different days went unanswered by the remaining nine fellowship programs, which raised concerns that they were likely also inactive despite being listed on various websites as being active. Twenty-nine programs indicated they had fellows. The overall response rate to all programs emailed was 22/45 (49%), but the response rate among programs that currently had fellows was 22/29 (76%).

Fifteen (68.2%) programs accepted one fellow per year, and seven (31.8%) accepted two fellows per year. One (4.6%) program was one year in length, while 21 (95.5%) programs were two years in length. Fellows averaged anywhere from 30-90 clinical hours per month, with an average of 61 hours (SD 13.5). The amount of time fellows spent outside the US varied widely, from a minimum of 2-28 weeks (median 8 weeks, IQR [6,16]), to a maximum of 8-52 weeks (median 24 weeks, IQR (15, 28)).

Nineteen (86.4%) programs offered a Master of Public Health (MPH) degree, while only three (13.6%) programs did not, with 14 (63.6%) programs requiring a MPH degree by time of graduation. Thirteen programs (59.1%) offered other degrees, such as a Diploma of Tropical Medicine and Hygiene, Master of Business Administration, Master of Science, and Global Health Certificate.

Respondents were asked to report how many research experiences accepted fellows participated in during residency on average. Three (13.6%) respondents did not know. One (4.6%) respondent reported zero experiences during residency; 12 (54.6%) respondents reported one experience; four (18.2%) reported two experiences; and two (9.1%) reported three experiences. Regarding research during fellowship, five (22.7%) programs reported that fellows participated in 0-1 research experiences during fellowship, six (27.3%) reported two research experiences, seven (31.8%) reported three research experiences, two (9.1%) reported four research experiences, one (4.6%) reported five experiences, and one (4.6%) reported over 10 research experiences during fellowship.

Sixteen programs (73%) offered the Health Emergencies in Large Populations course, 11 (50%) a humanitarian response class, and one (5%) offered the American College of Emergency Physicians Emergency Medicine Basic Research Skills course. Seven programs dedicated time to point-of-care ultrasound training, with amount of time ranging from 2-100 hours per year. A tropical medicine course was offered by 14 programs (64%) spanning 2-24 weeks (median 4 weeks, IQR 3.5-10.5 weeks). Other program offerings included attendance at the African Federation for Emergency Medicine and International Federation for Emergency Medicine meetings, disaster medical assistance team training and deployments, humanitarian emergency and hospital disaster simulation, physician leadership courses, and access to the World Health Organization.

Finally, programs were asked to report how many recent graduates from their program were practicing in each of the following settings. Programs reported 59% of graduates working

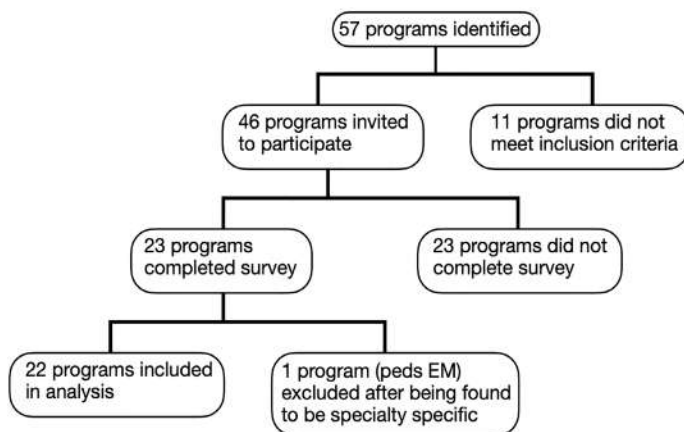


Figure 1. Global Emergency Medicine fellowship programs included. EM, emergency medicine.

in US academic centers; 24% of graduates in US community practice settings, 9% for nonprofit agencies, and 9% in international clinical practice.

DISCUSSION

This study demonstrates substantial variation in current GEM fellowship curricula. All participating fellowships offered advanced degrees, included international projects, and required clinical responsibilities. Areas of diversity included the specific degrees offered, amount of time devoted to clinical duties, travel, ultrasound training, and whether or not specific courses and conferences were included in fellowship curricula. Lack of accreditation permits GEM fellowship programs to customize their curricular offerings to each program's strengths. This lack of curricular consistency allows fellowship applicants to choose programs with curricula more tailored to their career goals. However, it also reflects a lack of standardized expectations within the growing field of GEM.

Our results are consistent with previous research that has established variability in fellowship curricula. There was no single experience offered by all responding programs, except for participation in an international project. Unlike Bledsoe et al.,² who reported that all GEM fellowships offered MPH training, we found 13.6% of programs did not offer a public health degree. As in the early 2000s survey, all responding programs were one or two years in duration and accepted one or two fellows per year. The amount of time devoted to clinical duties, and amount of time fellows could work overseas were widely variable, with average clinical hours varying threefold, from 30-90 hours per month. Fellows could spend as little as two weeks or as many as 52 weeks overseas each year, depending on the program. Fellowship applicants could choose from a range of advanced degree offerings, with MPH and Diploma of Tropical Medicine and Hygiene being most commonly available.

The majority of responding programs reported incoming fellows having participated in one research project during residency. Fellows typically completed up to three research projects during fellowship. No prior studies have reported research expectations prior to and during GEM fellowship.

Consistent with previous data, we found that a majority of fellowship graduates (59%) went on to work in university-affiliated academic settings. An additional 24% of graduates were reported to be working primarily in US community practice settings, for a total of 83% having a primary workplace within a US hospital or academic system. We found that 14% were reported to be working elsewhere, split evenly between international clinical practice and nonprofit agencies such as the US Centers for Disease Control and Prevention. Bledsoe et al. found that 79.3% of graduates worked in academic settings, and the remaining 20% in community practice. The field of GEM has grown over the past 20 years, and our research studied more than twice as many programs and graduates (22 programs and 80 graduates).

Despite the wide range of curricular components, there

have been some recent efforts within GEM toward increased consistency. We found that a uniform application platform and deadline for submission of GEM fellowship applications were supported by a majority of program directors and recent fellows. An agreement among GEM Fellowship Consortium (GEMFC) members now exists to not offer positions to prospective candidates until a designated "match" day in an attempt to maximize the ability of both prospective candidates and programs to identify the best match. While there has been some standardization around the administrative aspects of fellowship, the process of identifying key core elements that should be included in GEM fellowship is lacking, particularly given the lack of knowledge about the existing variability in curricula.

Most current fellows and recent graduates surveyed admitted to little knowledge of their fellowship curriculum prior to starting.¹¹ The Global Emergency Medicine Fellowship Consortium and the International Federation of Emergency Medicine recently collaborated to review methods of assessing GEM fellows. They found inconsistent methods of assessing fellows and created a consensus framework for a more standardized and outcome-oriented evaluation process.¹² While flexibility in curricula is important, more work is required to identify differences in curricula, the value of each course and experience to best identify whether a common denominator of curricula should exist across all GEM fellowships.

The reasons for variability in curricula are likely diverse. Each institution and fellowship leader brings different strengths and connections. There are likely financial reasons, as well. Emergency physicians in non-accredited fellowships are able to work as independent practitioners, and the revenue they generate may provide significant funding for fellowship programs.¹³

An unintended, interesting finding from our research was the surprising amount of difficulty in determining which fellowship programs are currently active. Outdated information online contributed to this problem. While 37 programs appeared to be active, 29 programs confirmed via phone or email that they had current or incoming fellows. After conclusion of the study, we reached out to the GEMFC; their most recent unofficial statistics for the 2019-2020 academic year showed 20 programs offering 26 slots (with five of the programs only accepting internal applicants).

Future directions for research include surveying GEM fellowship graduates to explore which aspects of their training were least and most helpful, and how fellowship has affected their career choices and opportunities.

LIMITATIONS

Limitations of this study include poor response rate. The reason for this is likely multifactorial. There were multiple programs contacted that reported being currently inactive, indicating that some non-responding programs may also be inactive. Jacquet et al. reported similar limitations to their 2013 survey, indicating that lack of an accurate count of current fellowships and lack of contact information have been a

long-term problem for GEM.¹¹ The data collection period was outside the fellowship application season, when fellowship email addresses may not be monitored as closely. This lack of accurate fellowship information online may pose a problem for potential applicants as well. Potentially higher response rates from programs with more resources may contribute to selection bias and over-representation.

Although we elucidated what experiences are commonly offered by international EM fellowships, we did not ask whether many of these experiences are required for graduation. Fellows often have leeway to choose which experiences are important to their career development, and we anticipate even less concordance in graduation requirements across programs compared to curricular offerings.

CONCLUSION

In summary, our results highlight the wide variety of experiences offered by global emergency medicine fellowships. While there are common offerings including an MPH, tropical medicine training, and Health Emergencies in Large Populations course, no experience was offered by all responding programs except for international travel. While many similarities exist in fellowship curricula, the flexibility from lack of standardization offers a wider array of possible experiences, which may benefit fellows with particular interests. We found that outdated publicly available information was very common; the time and effort spent in ascertaining what information was correct raises concerns that potential applicants may have difficulty as well.

Address for Correspondence: Wael Hakmeh, DO, Western Michigan University School of Medicine, Department of Emergency Medicine, 1000 Oakland Drive, Kalamazoo, MI 49008. Email: whakmeh@yahoo.com.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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Integration of Lung Point-of-care Ultrasound into Clinical Decision Making for Medical Students in Simulated Cases

Michelle Lum, MD*
Lauren Sheehy, MD†
Jason Lai, MD*
David Tillman, MD*
Sara Damewood, MD*
Jessica Schmidt, MD, MPH*

*University of Wisconsin, Department of Emergency Medicine, Madison, Wisconsin
†Tucson Medical Center, Department of Emergency Medicine, Tucson, Arizona

Section Editor: Andrew Phillips, MD

Submission history: Submitted June 15, 2020; Revision received November 21, 2020; Accepted December 1, 2020

Electronically published December 14, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.48717

Background: Point-of-care ultrasound (POCUS) has an emerging presence in medical student education; however, there is limited evidence that this translates into appropriate clinical care. We aimed to evaluate the ability of medical students to integrate newly obtained POCUS knowledge into simulated clinical cases.

Methods: We conducted an observational study of medical students participating in a mandatory rotation during their clinical years. Students in small groups underwent formalized lung POCUS lectures and hands-on training. Students participated in simulated “dyspnea” cases focused on either congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD). They were observed for critical actions including elements related to medical decision-making and ultrasound use and interpretation. Ultrasound-specific written knowledge was gauged with a short assessment after the first lecture and at week 4.

Results: A total of 62 students participated and were observed during simulations. All groups correctly identified and treated CHF in the simulated case. Most groups (7 out of 9) attempted to use ultrasound in the CHF case; five groups correctly recognized B-lines; and four groups correctly interpreted B-lines as pulmonary edema. No groups used ultrasound in the COPD case.

Conclusion: Most students attempted to use ultrasound during simulated CHF cases after a brief didactic intervention; however, many students struggled with clinical application. Interestingly, no students recognized the need to apply ultrasound for diagnosis and management of COPD. Future studies are needed to better understand how to optimize teaching for medical students to improve translation into POCUS skills and improved clinical practice. [West J Emerg Med. 2021;22(1)124-129.]

INTRODUCTION

Point-of-care ultrasound (POCUS) is an important diagnostic tool that has been adopted by physicians in several clinical specialties.¹ POCUS describes the use of ultrasound in a focused and goal-directed manner for a specific clinical context but does not encompass an entire comprehensive radiologic evaluation.² Given its clinical utility, calls have been made to incorporate POCUS education into medical school curricula, and a growing

number of medical schools have done just that.³⁻⁵ As Solomon et al wrote in the *New England Journal of Medicine*, “A generation of physicians will need to be trained to view this technology as an extension of their senses, just as many generations have viewed the stethoscope.”⁶ The future state of POCUS depends on training at all levels of medical education.

Several studies have shown that medical students are able learners and can be taught to perform POCUS with short

didactic training.⁷⁻¹² Yet there has been limited investigation of how POCUS teaching translates to clinical decision-making and practice. Several authors have emphasized that new technology does not always correlate favorably with clinical care.^{13,14} Understanding how medical students carry novel skills with them into clinical practice is essential to appropriately developing training curricula.¹⁵ The goal of teaching is to have students progress along Miller's framework from knowledge, to competence, to performance.¹⁶ High-fidelity simulation offers a venue to view learners' performance of POCUS. It also has the advantage over other assessment techniques of evaluating students in a controlled clinical environment.¹⁷⁻²² With regard to POCUS, simulated case scenarios provide an ideal method of observing skill translation in a controlled study setting.

We aimed to evaluate the ability of medical students in their clinical years to integrate newly obtained knowledge related to lung POCUS into clinical decision-making. While it has already been shown that students can readily acquire POCUS knowledge, we hypothesized that students may struggle to integrate POCUS into simulated case scenarios. We aimed to evaluate appropriate use of POCUS by observing students' ability to correctly acquire and interpret images and make appropriate changes in clinical management based on their findings.

METHODS

This study was an observational study of medical students at the University of Wisconsin, a large medical school in the Midwest. The study was conducted from January 2019–January 2020. At our institution, all medical students participate in a 12-week mandatory rotation termed the Acute Care Block (ACB), which includes multispecialty education in emergency medicine (EM), neurology, internal medicine, radiology, and psychiatry. The study was determined to be exempt by the University of Wisconsin Institutional Review Board and was approved by members of the medical school ACB curriculum team.

Curriculum Design

Lectures: We designed a lecture and hands-on training focused on lung POCUS targeted toward novice users. The lecture covered ultrasound physics, imaging modalities, artifacts, probe selection, and basic lung ultrasound including evaluation of lung sliding, A-lines, B-lines, and clinical correlates. Lectures also emphasized the use of lung POCUS in an undifferentiated dyspneic patient, including evaluation of pathologies such as pneumothorax and alveolar interstitial syndrome. Lectures were taught by faculty from radiology and EM. Students then practiced hands-on scanning skills with bedside instructors on live standardized patients (who were without pathology), and key concepts were reviewed. Students previously received core content instruction on the pathophysiology, clinical manifestations, and management of congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) as part of the standard medical school curriculum. This content was designed and reviewed by

Population Health Research Capsule

What do we already know about this issue?
We know that medical students are able learners of point-of-care ultrasound (POCUS) with only brief educational interventions.

What was the research question?
Will medical students successfully integrate newly obtained lung POCUS knowledge into medical decision making?

What was the major finding of the study?
Students struggled to translate knowledge of lung POCUS into performance in a simulated clinical scenario.

How does this improve population health?
Evaluating students' knowledge translation of POCUS skills allows us to improve targeted medical student didactics and refocus POCUS education on patient outcomes.

a group of faculty physician educators within internal medicine, EM, and radiology.

Dyspnea simulation: Students worked in groups of 3–5 students. Each group participated in one of two high-fidelity simulation cases relating to a patient with dyspnea. Cases were developed by a multidisciplinary educational faculty team specifically for the ACB rotation. In both cases, patients presented with a chief complaint of “shortness of breath.” In the first case, CHF, the patient had heart failure and presented with physical exam findings consistent with fluid overload including pitting lower extremity edema, bibasilar crackles, and low oxygen saturation. In the second case, the patient had COPD and presented with physical exam findings consistent with exacerbation, including wheezing. Students were not aware of a final diagnosis or pathologic findings prior to the case, and were only given the simulated patient's age, gender, and chief complaint of “shortness of breath” immediately prior to the start of the simulation.

Simulated POCUS: For both CHF and COPD simulation cases, an ultrasound machine was placed in the simulation room. If students chose to use the ultrasound, they were prompted by the simulation facilitator to describe where they were placing the probe and what structures or findings they were expecting to visualize. We incorporated a slight delay in obtaining a chest radiograph (CXR) during the simulation to allow the students the opportunity to incorporate POCUS. Because the simulation mannequin did not produce ultrasound images, static images

were presented to students on an in-room display screen in the same way that CXR, laboratory studies, or other diagnostic data were presented. Static images were used in lieu of video clips due to technical limitations of the available equipment.

Assessment

Knowledge-based: Students were administered a short, knowledge-based assessment immediately after the first didactic session on week 1 to evaluate POCUS knowledge acquisition. This assessment included questions specific to lung ultrasound interpretation and clinical management based on POCUS images. Students were administered an identical assessment, after the simulation exercise, in week 4 to assess for knowledge retention. Survey collection was performed using SurveyMonkey (San Mateo, CA). The assessment was created and reviewed by two ultrasound fellowship-trained faculty members.

Simulation: Simulations occurred during week 4 and were video recorded. Coding was completed using a predetermined rubric (Appendix A) detailing potential actions by two independent reviewers (LS and ML). This rubric was adapted from previously described checklists related to simulation and modified to our learners' training level.^{23,24} Discrepancies were mitigated by a third reviewer (JS). Reviewers noted whether students completed a specific task (eg, listen for breath sounds), and time of occurrence. If students performed a task more than once, only the first occurrence was documented. When students discussed but did not initiate a task (eg, initiating bilevel positive airway pressure), time was noted for first discussion and then, if applicable, for completed action.

Ultrasound-specific scoring: To assess the use of POCUS in a clinical scenario, the scoring rubric included tasks specific to ultrasound adapted from the Emergency Ultrasound Standard Reporting Guidelines: ACEP 2018.²⁵ These included correct probe selection, appropriate probe position, appropriate probe orientation, verbalized recognition of B-lines on images provided, and verbalized recognition of pulmonary edema.

Analysis

We compiled knowledge assessments in Microsoft Excel (Microsoft Corp, Redmond, WA) and performed statistical analyses using a paired two-sample for means t-test with a 95% confidence interval and interquartile ranges.

RESULTS

A total of 62 students participated in the ACB course during the study period. All students agreed to and were observed and evaluated during clinical simulation. Week 1 and week 4 knowledge assessment data was available for 50 individual students from July 2019–January 2020. We did not include 12 students' data due to missing data (overall response rate 81%). Reasons for missing data include technical difficulties.

Brief Knowledge-assessment Results

Overall, most students were able to correctly identify

normal lung images, including lung sliding (70% week 1 and 74% on week 4, $P = 0.62$) and could identify correct medical management (use of diuretics) in a patient with B-lines on ultrasound (86% week 1 and 82% week 4, $P = 0.60$). Students did demonstrate some knowledge decay from week 1 to week 4 with regard to recognition of specific lung pathologies, including pneumothorax with M-mode (88% on week 1 and 70% on week 4, $P = 0.038$).

Simulation Results

Students in 18 unique groups of 3-5 students participated in dyspnea simulation cases over the course of the study. Half (nine) of these groups participated in a COPD case simulation, and the other nine of these groups participated in a CHF case simulation. A total of 32 students participated in the COPD cases, and a total of 30 students participated in the CHF cases. During the simulated COPD cases, none of the groups used ultrasound. During the nine CHF case simulations, 89% of groups (8) discussed use of POCUS, and 78% (7) attempted to use the machine provided in the simulation room. Four groups (44%) chose the correct curvilinear probe to assess for B-lines. All groups that attempted ultrasound applied the probe to the anterior chest, although two groups were attempting echocardiography, for which they had not been formally trained in this course. We found that 55% of groups (5) were able to correctly identify B-lines. Three of these groups correctly verbalized that B-lines represent pulmonary edema. One group did not articulate the identification of pulmonary edema until it was confirmed on CXR. Another group incorrectly identified B-lines as representative of pneumothorax. Two groups did not use POCUS, but both of these groups correctly diagnosed CHF clinically prior to obtaining laboratory or imaging results. Most groups (6 out of 9) administered diuretics before any imaging resulted. The other three groups obtained POCUS images prior to diuretic administration. All groups correctly identified the diagnosis of CHF and treated appropriately with diuretics. In the COPD cases, 88% (8) of the groups initiated nebulizer treatments prior to any imaging being performed. Table 1 describes the average time for groups to perform critical actions during the simulated CHF case. Table 2 describes the number of groups who successfully completed ultrasound-specific actions. Timing of ultrasound is not shown for COPD cases as no groups attempted ultrasound.

DISCUSSION

As POCUS education continues to expand in medical schools, understanding how medical students will incorporate POCUS into their clinical decision-making is increasingly important. Some authors have raised concerns that acquiring information in lecture format may not actually translate into improved clinical skills. Feilchenfeld et al have previously commented: "the rationale that ultrasound training in [undergraduate medical education] will improve the quality of patient care was difficult to evaluate."¹⁴

Our study reflected previous findings that students readily gained POCUS knowledge after a brief didactic session. Overall, students were able to identify normal lung anatomy with lung sliding (74%) and lung pathology with B-lines (82%); however, they were inconsistent during simulation with correct probe selection (only 44% correct) and recognition of B-lines (56%). This may have been due to confusion between linear probe selection for evaluation of pneumothorax and curvilinear probe selection for B-lines, or our limitation of static images used during simulation due to technical issues. Differences in written knowledge assessment and simulations performance may also be due to increased cognitive burden between the two assessment modalities as further discussed below.

We also found that students demonstrated inconsistent application of POCUS in simulation. While most students did discuss using POCUS during the simulated CHF case (8 of 9), only seven of the groups went on to actually attempt image acquisition. Interestingly, although the students were trained specifically on lung POCUS, two of the groups attempted cardiac ultrasound instead of lung. This likely reflects additional knowledge students acquired during clinical rotations and observations of clinical practice. None of the groups attempted to use POCUS for the case of COPD. This is surprising as evaluating for pneumothorax or a cardiac etiology of wheeze is still important in an undifferentiated dyspneic patient. Students' decision not to use POCUS here may reflect their inexperience in approaching an undifferentiated patient. Alternatively, it may reflect a lower comfort level with POCUS—having had a few weeks pass since their last POCUS teaching—and an over-reliance on skills they were more comfortable with, such as physical exam.

Another interesting finding was that most groups provided medical management before any imaging was obtained—ultrasound or CXR. This could reflect the students' inexperience with creating differential diagnoses, or conversely that the cases were relatively straightforward and

students recognized the need for correct clinical management based primarily on physical exam and vital signs.

Medical students early in their clinical training, such as our group, have limited in vivo clinical experiences to draw from; it may have been difficult for students to approach the simulations as they would have a live clinical scenario, simply because they had encountered so few such scenarios in real clinical practice. Thus, the students' decision not to use ultrasound in the COPD case and to generally initiate management prior to diagnostics in both the CHF and COPD cases may reflect a view of the simulation as a hidden list of tick boxes—tasks to be completed—rather than a real clinical scenario, requiring movement through a differential diagnosis.

Another possibility is that there was a mismatch between the cognitive complexity of the simulation and the learner. This has previously been discussed as a potential pitfall of simulation.²⁶ Cognitive load theory would suggest that if learners have limited proficiency in the many tasks encountered in a simulation (eg, interpretation of vitals, interpretation of CXR, use of POCUS), then they will have difficulty translating any one of these skills into a clinically sound action. It is possible that in a lower complexity simulation, learners would have integrated ultrasound more robustly.

Overall, students in our study demonstrated difficulty translating *knowledge* of ultrasound into *performance* of ultrasound in a simulated clinical scenario. A number of possible explanations for this difficulty exist, including a lack of comfort with POCUS (due to insufficient hands-on training or training being too remote) and difficulty approaching the simulation as a real clinical scenario. It is also possible that the simulation was poorly matched to the learner—in terms of complexity—making a subtle transfer of POCUS skill more difficult to assess.

LIMITATIONS

Our study did have several limitations. First, as a single-center, observational study, the ability to generalize these

Table 1. Timing of critical actions completed by student groups during congestive heart failure and chronic obstructive pulmonary disease simulated cases.

Patient care task	CHF			COPD		
	Completed by groups	Time (range)	Time (average)	Completed by groups	Time (range)	Time (average)
Request vital signs	100%	0:00-0:48	0:18	100%	0:20-1:31	0:40
Listen for breath sounds	100%	0:26-4:04	1:40	100%	0:27-2:48	1:22
Apply O ₂	100%	0:16-1:54	1:05	100%	0:23-2:05	1:11
Order diuretic	100%	5:27-16:57	6:41	0%	NA	NA
Order nebulizer	0%	NA	NA	100%	3:20-5:40	4:14
Request CXR	100%	3:02-11:00	9:36	100%	2:09-8:48	5:47
Use ultrasound	78%	6:51-13:51	9:23	0%	NA	NA

CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CXR, chest radiograph.

Table 2. Proportion of groups completing ultrasound-specific actions.

Ultrasound skill	Completed by groups
Appropriate probe selection	44%
Appropriate probe position	78%
Recognize B-lines	56%
Recognize pulmonary edema	44%

findings may be limited. Second, the curriculum may have been too limited to adequately prepare students for simulated clinical applications. Third, students were assessed via a simulated case scenario (with potential pitfalls as detailed above); this may not reflect how they would manage patients in real life. However, given the innumerable external variables involved with direct observation, we felt that high-fidelity simulation provided a reasonable approximation, with the benefit of environment control as previously mentioned. Students also completed simulated cases in groups, making it difficult to compare execution in this arena with scores on the knowledge assessment, which was completed individually. Finally, students were assessed early in their clinical training and may not have been adequately prepared to work through a differential diagnosis in real time.

CONCLUSION

As medical schools continue to develop POCUS curricula for students, a greater understanding is needed as to how students will incorporate these skills into clinical decision-making. Our study demonstrated that students were able to acquire POCUS-related knowledge after a brief didactic session but struggled to apply this knowledge in simulated clinical scenarios. More research is needed to determine how best to move learners from POCUS knowledge acquisition to application, and to determine how best to assess this process.

Address for Correspondence: Jessica Schmidt, MD, MPH, University of Wisconsin, Department of Emergency Medicine, 800 University Bay Drive, Suite 310, Madison, WI 53715. Email: jschmidt@medicine.wisc.edu.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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A Near-Peer Educational Model for Online, Interactive Learning in Emergency Medicine

Hailey B. Rosenthal, BA
Neha Sikka, BS
Adam C. Lieber, BA
Charles Sanky, MPH
Christian Cayon, BA
Daniel Newman, BA, BS
Denisse R. Marquez, MPP
Jacob Ziff, BS
James R. Blum, BS
Jennifer B. Dai, BS
Phillip Groden, BS
Sara Pasik, BA
Trevor Pour, MD

Icahn School of Medicine at Mount Sinai, Department of Emergency Medicine, New York, New York

Section Editor: Jonathan Fisher, MD, MPH

Submission history: Submitted July 15, 2020; Revision received December 11, 2020; Accepted December 14, 2020

Electronically published December 21, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.49101

Introduction: The COVID-19 pandemic led to a large disruption in the clinical education of medical students, particularly in-person clinical activities. To address the resulting challenges faced by students interested in emergency medicine (EM), we proposed and held a peer-led, online learning course for rising fourth-year medical students.

Methods: A total of 61 medical students participated in an eight-lecture EM course. Students were evaluated through pre- and post-course assessments designed to ascertain perceived comfort with learning objectives and overall course feedback. Pre- and post-lecture assignments were also used to increase student learning.

Results: Mean confidence improved in every learning objective after the course. Favored participation methods were three-person call-outs, polling, and using the “chat” function. Resident participation was valued for “real-life” examples and clinical pearls.

Conclusion: This interactive model for online EM education can be an effective format for dissemination when in-person education may not be available. [West J Emerg Med. 2021;22(1)130-135.]

BACKGROUND

On March 17, 2020, the American Association of Medical Colleges issued guidance that encouraged schools to implement a two-week suspension of clinical activities for medical students due to the COVID-19 pandemic.¹ This guidance was extended, and in-person clinical education for medical students was halted nationally for months.² This interruption impacted medical students in countless ways,

ranging from educational to professional development.^{3,4} Time away from clinical rotations was particularly disruptive for students applying into emergency medicine (EM) due to delayed exposure to the field, the historical importance of Standardized Letters of Evaluation (SLOE), and the unique effect of the pandemic on the emergency department.⁵

Recognizing the impact of this disruption on students interested in EM, the American College of Emergency

Physicians, Emergency Medicine Residents' Association, and Council of Residency Directors in Emergency Medicine issued a joint guidance encouraging schools to "explore novel programs to expose medical students to virtual clinical experiences."⁶ This direction has been adapted across medical education through innovative approaches to online learning formats — from small-group teaching and specialty-specific clinical skills to online clinical bootcamps.⁷⁻⁹ In EM, remote learning has connected medical students to the clinical environment, while learning activities for residents have largely shifted online.^{10,11} These transitions have brought their own trials and opportunities.^{12,13}

Given the challenges faced by students and the sudden shift to online education, there was an immediate demand to provide reputable options for interested individuals. This need presented an opportunity to bolster the education of these students through a novel online format. Previous work has evaluated curriculum in EM for third-year medical students, and the field has a rich tradition of engaging with continued learning through free, open access education (FOAM).^{14,15} As an educational model, case-based learning has been shown to successfully balance inquiry and structure, allowing students to efficiently accomplish case objectives while maintaining freedom for creativity and demonstrating problem-solving skills.^{16,17} Based on a review of the existing literature on medical education in EM, a peer-led, case-based online learning opportunity has not yet been evaluated as a means of educating medical students in their clinical years. We sought to create such a curriculum in the hopes of supporting medical students' own education during this exceptional time while simultaneously assisting their peers with a shared interest in EM. Additionally, we sought to create a model that could be disseminated to other institutions, with the goal to fill this gap in clinical medical education.

OBJECTIVES

The objective of the course, titled "Case-Based Approach to Emergency Medicine," was to provide an interactive, digital modality to learn the basics of EM with fellow students and EM residents. This course was developed in April 2020 by and for medical students at the Icahn School of Medicine at Mount Sinai in New York City while much of the faculty were burdened with the significant increase in clinical responsibilities due to the COVID-19 pandemic. A group of 12 rising fourth-year medical students (MS4) organized the course and content under the supervision of the faculty mentor for this project, who serves as the Director for Undergraduate Medical Education for the Department of Emergency Medicine at the Icahn School of Medicine at Mount Sinai. In addition to guiding and approving important topics to include in the curriculum, this faculty mentor was also responsible for reviewing content prior to its use.

To identify appropriate topics for each lecture, the MS3 and MS4 topics from the Society of Academic Emergency Medicine's (SAEM) Clerkship Directors in Emergency Medicine curriculum were reviewed and selected with the approval of the faculty mentor.¹⁸ Eight topics were identified and ultimately presented in the following order: EM imaging; chest pain and electrocardiogram (ECG); stroke and lumbar puncture; abdominal pain; altered mental status and toxicology; shortness of breath and ventilators; shock, sepsis, and intravenous fluids; trauma and the focused assessment with sonography for trauma (FAST) exam. Each lecture was created and presented by a team consisting of one or two medical students and an EM resident at their institution. Teams were responsible for the following: identifying two to three learning objectives to guide each lecture's content; determining and providing pre-learning assignments; creating and presenting the lecture; and developing a post-lecture "homework" assignment. Lectures featured a short didactic followed by case-based discussions related to the lecture objectives. All lecture content and objectives were reviewed by the faculty mentor.

Pre-lecture assignments primed students for each upcoming topic and included podcasts, publications, clinical vignettes, and online content reviews. The lectures consisted of case reviews and didactics led by each team's medical students, supplemented by residents who supplied real-life scenarios and clinical pearls. Lecturers engaged the class by asking questions throughout the presentation in a variety of ways that included the following: individual cold-calling (from a randomized roster list); cold-calling in groups of three; asking for volunteer responses in the video conference platform's "chat" feature; using an online group polling software; and finally using the video conference platform's "hand raise" feature. At the end of each lecture, the students were assigned homework to reaffirm their grasp of the material.

CURRICULAR DESIGN

Student Cohort

Recruitment for the course occurred approximately one week prior to the first lecture via an email sent out to medical students highlighting the course objectives, requirements, and schedule along with an attached sign-up sheet. In response to an overwhelming volume of students who expressed interest, and to preserve a highly participatory learning environment, a cap of 50 rising MS4s was implemented by the course creators and faculty mentor. Ultimately, a total of 61 students participated in the course, including the 12 organizing students. Participating students received two credits—a typical distribution for medical student electives—for completion of the two-week course. The 12 students responsible for the creation of this course received an additional two elective credits for a total of four credits. The residents involved in the course graciously volunteered their time amidst their busy clinical schedules for the benefit of interested students, without receiving any credit or compensation.

Data Collection Process

Before course enrollment, participants were asked for informed consent for analysis of their pre-assessment, post-assessment, pre- and post-lecture assignments, and other elements of course participation included in this study. This study was submitted for approval and deemed exempt by the institutional review board.

Logistics

The course was held from April 7–May 5, 2020, and consisted of eight, 60-90 minute twice-weekly lectures. Pre-learning assignments were sent out via email at least two days prior to each class. The lectures were conducted via an online video-conference platform with sufficient bandwidth for all class participants. Post-lecture assignments were sent out immediately after the completion of the lecture and due the morning of the subsequent lecture, when answers were reviewed. Participants' grades in the course reflected participation in lecture and completion of assignments. Assignments were not graded for accuracy.

Pre and Post Assessments

Prior to the first lecture, enrollees completed an anonymous pre-assessment survey. Information was collected regarding their class year, previously completed clinical experiences both within and outside of EM, and self-perceived comfort with each lecture's learning objectives. The topic-specific questions were formulated by the respective team leaders. These objectives were assessed before and after the course using a Likert scale of 1-5, ranging from "very uncomfortable" to "very comfortable." Following the completion of the course, enrollees were sent a post-assessment survey using the same variables as the pre-assessment. We evaluated differences between mean pre-assessment and post-assessment scores using a two-tailed t-test. Significance was set as a *P*-value of less than 0.05. Additionally, they were asked to provide feedback on the course as a whole, which included the following: resident participation; student engagement; lecture style and value; and pre- and post-lecture assignments.

IMPACT/EFFECTIVENESS

Cohort

A total of 61 rising MS4 students attended the course, 12 of whom both attended all lectures and were responsible for leading one lecture. Of the attendees, 58 students (95%) filled out the pre-assessment survey and four students (6.9%) had just returned from a gap year between their MS3 and MS4 years. Seventeen students (29.3%) had completed an EM elective prior to this course, and 42 students (68.8% of the class participants) completed the post-assessment survey.

Responses

Before the class, students were least confident in their

knowledge of EM-specific clinical skills such as "conducting and interpreting the FAST exam," "understanding indications for invasive and non-invasive ventilation," "reading and interpreting ECGs," and "understanding the steps of a lumbar puncture," all of which had mean confidence scores of 2.40 or less. After the class was completed, mean confidence scores improved across all learning objectives ($P < 0.05$) (Table 1). Overall, students found the clinical cases and real-life examples to be the most useful parts of the course (Figure 1). Students felt the ideal amount of resident teaching would be 40-70% of the course material, with peer instructors teaching the rest. In particular, students valued when residents provided real-life examples and shared pearls of wisdom and caveats. Based on free-text comments, students felt a good balance was achieved between peer instruction and resident instruction: peers could teach most of the "didactic" material with a focus on what is emphasized at their training level; and residents could then provide more depth when needed, caveats, and "real-life" examples to make the material come alive, and be available to answer questions.

We assessed five different methods of class participation (Figure 2). A combination of calling on students in groups of three, online group polling software, and asking for volunteer responses in the video conference platform's "chat" feature were found to maximize learning and engagement without sacrificing student perceived enjoyment/comfort. Cold-calling individuals, while good for engagement, was not considered as helpful for learning, and was the least enjoyable/comfortable method. Using the "hand raise" function, while comfortable, was not as engaging and did not facilitate as much learning. Based on free-text responses, individual cold-calling added stress and reduced enjoyment in the course. Students suggested that this method potentially inhibited learning because students were more focused on whether they would be called on rather than on the material itself.

Chief complaint overviews from the SAEM MS3 curriculum¹⁸ and podcasts were considered the most valuable types of pre-reading material. A total of 76% of respondents reported completing greater than 50% of the assigned pre-reading. Homework assignments were considered helpful, especially when they were more challenging and forced critical thinking, rather than simply testing knowledge of definitions and basics.

DISCUSSION

The purpose of creating this novel EM curriculum was to 1) bolster the education of our peers during a period of significant disruption to our traditional clinical learning opportunities, and 2) prove the efficacy of a student-led, remote course in engaging students and increasing their knowledge base on core EM topics. Previous survey of student attitudes toward online learning during the COVID-19 pandemic demonstrated general dissatisfaction;

Table 1. Pre-course and post-course assessment of comfort with learning objectives in an online emergency medicine course led by near-peers.

Lecture	Objective	Pre-course mean	Post-course mean	Relative difference	P-value
Imaging	Reading a chest radiograph	3.03	3.73	23.0%	<0.001
	Interpreting a CT	2.57	3.51	36.6%	<0.001
	Developing a differential and using imaging to establish a diagnosis	2.98	3.83	28.3%	<0.001
Chest Pain and EKG	Using a framework to approach chest pain in the ED Setting	3.25	4.02	24.0%	<0.001
	Reading and interpreting ECGs	2.34	3.02	29.0%	<0.05
Stroke and Lumbar Puncture	Recognizing signs and symptoms of a stroke	3.72	4.29	15.3%	<0.001
	Describing initial management of an acute stroke	3.34	4.07	21.8%	<0.001
	Understanding the steps of a lumbar puncture	2.40	3.59	49.6%	<0.001
Abdominal Pain	Recognizing when emergent resuscitation is required	2.78	4.05	45.9%	<0.001
	Creating a differential diagnosis for abdominal pain	3.76	4.39	16.8%	<0.001
	Understanding the imaging work-up for abdominal pain	3.24	4.10	26.4%	<0.001
Altered Mental Status and Toxicology	Creating a differential diagnosis for altered mental status in the ED	3.19	4.27	33.8%	<0.001
	Differentiating between different presentations of common toxidromes	2.40	3.68	53.7%	<0.001
	Understanding the components of a basic toxicology screen	2.47	3.68	49.4%	<0.001
Shortness of Breath and Ventilators	Assessing shortness of breath in the ED	3.23	4.02	24.7%	<0.001
	Understanding the indications for invasive and non-invasive ventilation	2.09	3.39	62.5%	<0.001
Shock and Sepsis	Understanding how to classify shock based upon a bedside examination	2.38	3.83	60.9%	<0.001
	Identifying several causes of shock	3.14	4.22	34.5%	<0.001
Trauma and FAST Exams	Managing a trauma patient who initially arrives in the ED	2.24	3.61	61.1%	<0.001
	Conducting and interpreting the FAST exam	1.93	3.29	70.5%	<0.001

CT, computed tomography; ECG, electrocardiogram; ED, emergency department; FAST, focused assessment with sonography for trauma.

students emphasized that currently available methods are asynchronous and that they largely prefer in-person learning due to the lack of interactive experiences available and the subsequent inability to ask questions while learning.¹⁹ We demonstrated that engagement can be attained on a virtual platform and that this mode of clinical education, while not ideal, was sufficient for increasing students' perceived comfort with core clinical concepts. This methodology

can be applied to situations where in-person learning is unavailable, beyond the COVID-19 pandemic.

Strengths of this project included a highly motivated group of medical students to serve simultaneously as course organizers and lecturers, support from experienced EM residents in reviewing lecture content and providing clinical pearls during presentations, and faculty to provide oversight to the course structure and lecture-specific learning objectives.

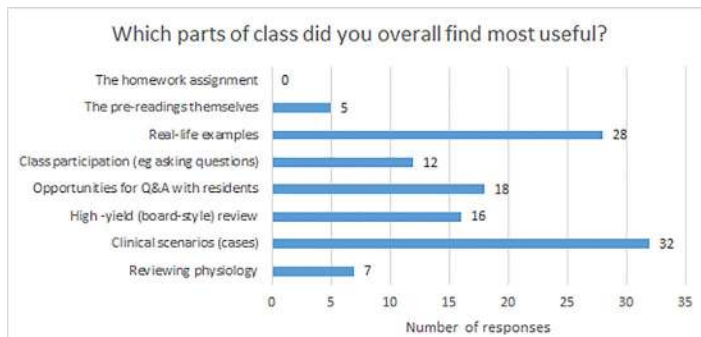


Figure 1. Responses to the question “Which parts of the class overall did you find most useful?” Q&A, question and answer.

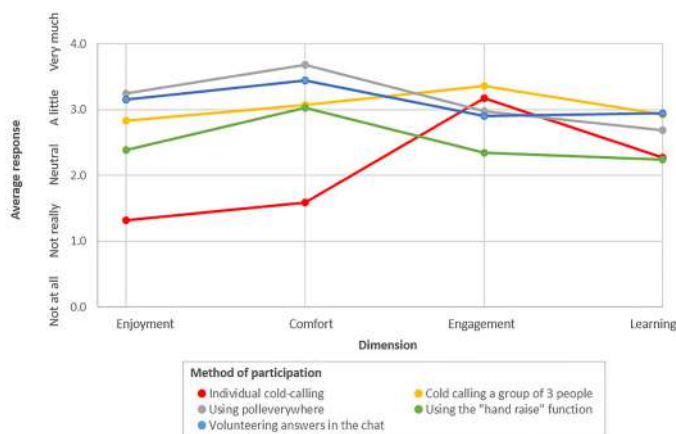


Figure 2. Class participation. Average response to the question “How much did [method of participation] help with your [dimension] during class?”

The speed with which the course organizers were able to construct this novel curriculum speaks to the feasibility of recreating this model when needed.

While students generally felt satisfied with the amount and content of resident teaching during each lecture, an acknowledged challenge was deciding how to best use and standardize the residents’ input. Strategies to increase resident involvement included asking resident lecturers to monitor the “chat” of the video-conferencing platform and answer participant questions in real time, describe cases from their clinical experience relevant to the lecture topic, and explain the steps of clinical procedures included within the presentations themselves. One method to further integrate resident participation into the student-led lectures was through a “rehearsal” lecture prior to the scheduled class, such that resident-provided “clinical pearls” could be coordinated within the flow of the presentation. Limitations to implementing this across lectures included the rapid transition from course creation to presentation and the often conflicting schedules of students and residents.

Overall, zero participants found homework as the most useful aspect of the course, and very few found pre-reading most useful. Homework assignments were not graded, which has been shown to reduce perceived usefulness by Doom et al.²⁰ Rather, clinical scenarios and real-life cases were rated as most useful, emphasizing the strength of the participatory, case-based aspects of the course. In future iterations of this course, further emphasis and review of pre- and post-lecture assignments may increase perceived educational value.

A key focus of this project was optimization of participation strategies to balance student comfort with engagement. While the concept of case-based learning itself is well supported in the literature, the body of evidence suggesting the optimal strategy for engaging students on a virtual platform is in its early stages of development.^{16,17} Morawo et al acknowledge the ease and inevitability of low engagement during virtual learning. They used polling software to demonstrate that learners were more actively engaged with the use of quizzes, both anonymously and in groups, but did not determine which modality was preferred and were limited in the modalities tested.²¹

Strategies for student engagement in this course changed throughout based on real-time feedback from participating students. Early in the course, student participation was garnered primarily in a “cold-call” fashion, in which individual students were randomly selected to answer a clinical question. While some students expressed favor with this strategy, others felt discomfort. This feedback led to use of group-based questions (ie, calling on three people simultaneously), anonymous participation (ie, using a polling software), and low stakes participation (ie, using the video conference “chat” function) for subsequent lectures. Three-person call-outs, polling, and the “chat” function are particularly effective in an online environment where participants are not always visible, and muting and unmuting can be cumbersome.

Some aspects of the course limited analysis. Attendance for each session, although near 100% based on comparison of the chat participants with the number of enrolled students in real-time, was not recorded; however, pre- and post-lecture assessments were monitored for completion and achieved a high rate of involvement. Use of anonymous and low-stakes participation limited the ability to objectively measure how many students engaged in each method; rather, analysis was based on feedback in the post-course assessment.

CONCLUSION

Overall, the EM curriculum presented here provided valuable education to students impacted by curriculum disruptions due to the COVID-19 pandemic. With further refinement, we hope that this model for course dissemination can be adapted in other institutions to further students’ education.

Address for Correspondence: Trevor Pour, MD, Icahn School of Medicine at Mount Sinai, Department of Emergency Medicine, 3 East 101st Street, Box 1620, New York, NY 10029. Email: trevor.pour@mountsinai.org.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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The Challenging Case Conference: A Gamified Approach to Clinical Reasoning in the Video Conference Era

Scott Kobner, MD
Molly Grassini, MD
Nhu-Nguyen Le, MD
Jeff Riddell, MD

LAC+USC Medical Center, Keck School of Medicine, University of Southern California,
Department of Emergency Medicine, Los Angeles, California

Section Editor: Abra Fant, MD

Submission history: Submitted July 15, 2020; Revision received December 15, 2020; Accepted December 15, 2020

Electronically published December 23, 2020

Full text available through open access at http://escholarship.org/uc/uciem_westjem

DOI: 10.5811/westjem.2020.12.49133

The development of clinical reasoning abilities is a core competency of emergency medicine (EM) resident education and has historically been accomplished through case conferences and clinical learning. The advent of the SARS-CoV-2 pandemic has fundamentally changed these traditional learning opportunities by causing a nationwide reliance on virtual education environments and reducing the clinical diversity of cases encountered by EM trainees.

We propose an innovative case conference that combines low-fidelity simulation with elements of gamification to foster the development of clinical reasoning skills and increase engagement among trainees during a virtual conference. After a team of residents submits a real clinical case that challenged their clinical reasoning abilities, a different team of residents “plays” through a gamified, simulated version of the case live on a video conference call. The case concludes with a facilitated debriefing led by a simulation-trained faculty, where both the resident teams and live virtual audience discuss the challenges of the case. Participants described how the Challenging Case Conference improved their perceptions of their clinical reasoning skills. Audience members reported increased engagement compared to traditional conferences. Participants also reported an unexpected, destigmatizing effect on the discussion of medical errors produced by this exercise. Residency programs could consider implementing a similar case conference as a component of their conference curriculum. [West J Emerg Med. 2021;22(1)136-138.]

BACKGROUND

Physicians commonly learn clinical reasoning through “whole-case” format conferences in which a presenter chronologizes a patient’s presentation, diagnosis, and treatment. However, these conferences may lack characteristics that improve the acquisition of clinical reasoning abilities, such as active learner involvement, uncertainty of clinical practice, and multiple diagnostic or therapeutic choices.¹⁻⁴

Alternatives to traditional case conferences may rely on group gatherings that are no longer possible in the era of SARS-CoV-2 (COVID-19).^{2,4,6} Furthermore, emergency departments nationwide are reporting a decline in the number and diversity of non-COVID-19 cases, increasing trainee’s reliance on supplemented clinical reasoning experiences to meet Accreditation Council for Graduate Medical Education

core competencies.^{7,8} Teaching clinical reasoning to trainees who are spatially distant can be challenging because audience engagement is difficult during video conferencing, active participation is limited, and financial and technological barriers make virtual simulation difficult.⁹

Gamification—the application of characteristics of games for health professions education—is a modern teaching modality that provides learners with active learning opportunities and improves clinical problem-solving.^{10,11} Despite similarities with commercial, tabletop role-playing games, gamification has not been widely adopted for teaching clinical reasoning in low-fidelity simulation settings. Here we provide a description of a novel case conference format that uses the gamification of low-fidelity simulation to teach clinical reasoning skills to a large audience of virtual participants.

OBJECTIVES

Broadly, we sought to develop a curriculum for the virtual conference format that would foster development of clinical reasoning skills. By gamifying serial-cue, low-fidelity simulations we additionally aimed to improve engagement in clinical case conferences for a spatially distant audience of learners during our weekly residency conference.

CURRICULUM DESIGN

The Challenging Case Conference consists of three parts: a standardized case submission; a live tabletop simulation; and a subsequent debrief discussion with virtual facilitation.

Prior to the conference, a team of residents submits a real case that challenged their clinical reasoning skills. Case submissions include all relevant diagnostic results, and residents are encouraged to highlight several elements of the case that challenged their clinical reasoning abilities. This submission also includes a brief case conclusion that summarizes their experiences with the case. All clinical data is reviewed by the case facilitator to ensure all patient identifiers have been removed prior to inclusion in the conference.

Next, a different team of 3-5 residents, with no knowledge of the case, “plays” through a simulated tabletop version of the case live on a video conference call during our weekly resident didactics. This team was comprised of members across all four postgraduate years, meeting in person and in virtual attendance. Akin to a mock oral boards case, this case flow is facilitated by a chief resident familiar with serial-cue tabletop simulation and gaming techniques.

Whenever participants ask to perform interventions during the case, they are instructed to roll a set of dice. On a roll of 10-12, the action is successful (the patient gets intubated); on a roll of 7-9, success comes with an unexpected consequence (intravenous access was obtained, but only with a small bore catheter); on a roll of 1-6, the action is unsuccessful (the patient became hypotensive). Vital signs are provided to the team and virtual audience through Simpl (a commercially available simulated cardiac monitor, www.simplsim.com). All de-identified lab and imaging results are housed in a Dropbox (www.dropbox.com) folder. As team-members ask for diagnostic studies during the play of the case, a facilitator puts a hyperlink to the Dropbox file correlating with their request (chest radiograph, urinalysis, etc.) in the virtual chat room, making the data available to both team members and the audience (Figure 1).

The resident team working through the clinical case can see the virtual chatroom, where other trainees and faculty can remotely comment on the case as it unfolds. At the conclusion of the case, simulation-trained faculty lead a debriefing with the team that submitted the case and the simulation participants. The two teams discuss the various challenges present in the case and engage in a real-time discussion with the virtual audience.

This educational methodology was chosen to combine the strengths of gamification, serial-cue case discussions, and low-fidelity simulation while minimizing the known obstacles



Figure 1. Screenshot of the Zoom application during the case simulation. Resident participants (center screen) play through a simulated case on a live video broadcast, with real-time simulated clinical data overlaid on the video stream (bottom left corner) for audience members (top left) to view. A scrolling, real-time chat feed (right) is visible to audience and participants alike.

imposed by the virtual environment. The moment-to-moment uncertainty that is theorized to improve clinical reasoning skills in a serial-cue case approach is naturally complemented by the gamified uncertainty of dice probabilities.^{3,7}

IMPACT/EFFECTIVENESS

During a recent conference, this exercise took 43 minutes, involved a virtual audience of 89 trainees and faculty, and had 52 distinct comments in the chatroom. Chat comments were largely real-time clinical reasoning pearls, questions about the case, and suggestions to participants. Following the case debriefing, 11 minutes of spontaneous faculty discussion ensued, which covered themes ranging from diagnostic decision-making and airway management to systems-level patient safety issues and foundational medical knowledge.

We interviewed a convenience sample of volunteer attendees directly following this conference, which included three simulation participants, five resident audience members, and three residency program administrators. Semi-structured interviews were conducted with a standardized set of questions (Appendix 1) designed to explore perceptions of the curriculum from multiple sources. Transcribed responses underwent a basic thematic analysis to reveal several key trends. All simulation participants felt that the tabletop simulation improved their clinical reasoning ability in ways that mimicked real clinical encounters. They reported that the dice element both added a level of unpredictability, which helped model the actual practice of emergency medicine (EM) and also added a level of excitement absent from typical mock oral boards-type tabletop simulations. All three residents initially endorsed anxiety participating in front of a live virtual audience, but agreed that this anxiety dissipated during the exercise. Interestingly, all participants described a normalization phenomenon, wherein openly acknowledging challenges with the clinical reasoning

in the simulation and real case produced an honest, stigma-free discussion of medical errors.

Audience members agreed that they were more engaged throughout the case simulation than during traditional case conferences due to the format and gamification. Two junior trainees reported that the gamification allowed them to witness participants work through uncertainty in real time, which informed their developing practice. Residency program administrators noted increased faculty engagement and discussion when compared to historical case conferences. Finally, interviewees suggested using an alternative to Dropbox to view diagnostic results to limit interruptions in the case flow and to use more gamification throughout the simulation.

CONCLUSION

The Challenging Case Conference uses elements of low-fidelity simulation and serious games to increase perceptions of clinical reasoning skills for a virtual audience of EM trainees, while also increasing perceptions of virtual participation.

Address for Correspondence: Scott Kobner, MD, LAC+USC Medical Center, Keck School of Medicine, University of Southern California, Department of Emergency Medicine, 1200 N. State St, Suite A7D, Los Angeles, CA 90033. Email: scottkobner@gmail.com.

Conflicts of Interest: By the WestJEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There are no conflicts of interest or sources of funding to declare.

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