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Western Journal of Emergency Medicine:

Integrating Emergency Care with Population Health

Indexed in MEDLINE

COUNCIL OF RESIDENCY DIRECTORS IN EMERGENCY MEDICINE

Special Issue on Educational Research and Practice

CALIFORNIA ACEP
AMERICAN COLLEGE OF EMERGENCY PHYSICIANS

ACOEP
The American College of Osteopathic Emergency Physicians

UC Irvine Health

CALAAEM
CALIFORNIA CHAPTER DIVISION OF THE AMERICAN ACADEMY OF EMERGENCY MEDICINE

A Peer-Reviewed, International Professional Journal

VOLUME 26, Issue 1.2, January 2025

PAGES 1-68

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ACOEP
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Western Journal of *Emergency Medicine*:
CDEM/CORD 2025 Special Education Issue

A Note from the Editors:

We are excited to publish the 10th issue of the Western Journal of Emergency Medicine (WestJEM) Education Issue and first year of a rolling decision process. Over 10 years ago a unique relationship was formed between WestJEM, the Council of Residency Director for Emergency Medicine and the Clerkship Directors of Emergency Medicine. The idea was to promote and disseminate educational scholarship which has been accomplished over the past decade. Senior and junior researchers have an opportunity to publish in the education issue because of the diverse nature of our submission categories, ranging from original research to brief educational advances. A successful issue requires the courage of the authors to submit their work for peer review and we do our best to provide detailed feedback regardless of the final decision. Publication of the issue requires the commitment and hard work of the publication staff, leadership of the organizations, editors, and peer reviewers. We want to thank them all for their efforts and professionalism. The topics of this year's education issue likely reflect the focus of educators as we entered a post-covid reality. Many of the topics were related to innovative curriculums and focused on the benefits derived. There were also several articles that were dedicated to the administrative aspects of residency and fellowships and how that has changed after COVID. We have already started to receive and review submissions for next year's education issue. The editorial staff review every submission on a rolling basis and, once accepted, the articles are available on PubMed. There are also no processing fees when accepted to the Education Issue. This is a great opportunity to submit your educational scholarship, thereby enhancing your professional development and disseminating your work to others. We are excited that this experiment has flourished, and we look forward to seeing your work in our 11th issue.

Jeffrey Love, MD
Georgetown University School of Medicine
Co-Editor of Annual Special Issue on Education Research and Practice

Douglas Ander, MD
Emory University
Co-Editor of Annual Special Issue on Education Research and Practice

The *Western Journal of Emergency Medicine: Integrating Emergency Care with Population Health* would like to thank The Clerkship Directors in Emergency Medicine (CDEM) and the Council of Residency Directors in Emergency Medicine (CORD) for helping to make this collaborative special issue possible.

Western Journal of *Emergency Medicine*:

Integrating Emergency Care with Population Health

Indexed in **MEDLINE, PubMed, and Clarivate Web of Science, Science Citation Index Expanded**

JOURNAL FOCUS

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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Policies for peer review, author instructions, conflicts of interest and human and animal subjects protections can be found online at www.westjem.com.

2024 Gold Standard Reviewers

The *West*JEM 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. This year's "Gold Standard" includes:

- Dave Carlberg
- Michael Cassara
- Max Griffith/Bjorn Watsjold*
- Alana Harp/Deena Bengiamin*
- Mojibade Hassan/Kathleen White/Brad Barth*
- Heather Hechter
- Adam Heilmann/Erin Kane/John Schneider/Albert Kim*
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*Mentored Peer Reviews from Emergency Medicine Education Fellowship Programs

CDEM/CORD Guest Consulting Editors

We would also like to recognize our guest consulting editors who assisted with pre-screening submissions during our initial peer-review stages. Thank you for all of your efforts and contributions.

CDEM

- Christine Stehman
- Eric Shappell
- Sharon Bord
- Andrew Golden

CORD

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COUNCIL OF RESIDENCY DIRECTORS IN EMERGENCY MEDICINE

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Program Signaling in Emergency Medicine: The 2022–2023 Program Director Experience

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Introduction: Program signaling (PS), which enables residency applicants to signal their preference for a specific program, was introduced in emergency medicine (EM) in the 2022–2023 residency application cycle. In this study we evaluated EM program directors' (PD) utilization of PS in application review and ranking. This study also explores the relationship between program characteristics and number of signals received as well as the relative importance and utilization of signals related to the number of signals received.

Methods: This is an institutional review board-approved, cross-sectional study of PDs at Accreditation Council for Graduate Medical Education-accredited EM residency programs. We used descriptive statistics to describe the characteristics of residency programs and practices around PS. Measures of central tendency and dispersion summarized continuous variables. We used chi-square analysis or the Fisher exact test for comparisons between groups for categorical variables. Comparisons for continuous variables were made using the *t*-test for independent samples or analysis of variance.

Results: The response rate was 41% (n = 113/277 EM programs). Most programs participated in PS (n = 261/277 EM programs, 94.2%). Mean number of signals received was 60 (range 2–203). Signals received varied based on program characteristics including geographic location and program type, duration, environment, and longevity. Most used PS in holistic review (52.2%), but other uses varied by proportion of applications that were signaled. The importance of PS in application review (mean 2.9; 1–5 scale, 1 = not important, 5 = extremely important) and rank list preparation (2.1) was relatively low compared to other application elements such as standardized letters of evaluation (4.97 for review, 4.90 for ranking).

Conclusion: The study provides insights into PS utilization in EM's inaugural year. We have identified patterns of signal use based on program characteristics and number of signals received that can inform signal allocation and utilization on an individual applicant and program level. A more nuanced understanding of signal use can provide valuable insight as the specialty of EM grapples with fluctuations in its applicant numbers and shifting demographics of its applicant pool. [West J Emerg Med. 2025;26(1.2)1–10.]

INTRODUCTION

Program signaling (PS) was introduced into the residency application process in response to the increasing number of applications received by programs, exacerbating the challenge of comprehensive holistic review.[1] Subsequently, EM has experienced drastic fluctuations in the number of applicants pursuing EM and specialty Match rates, as well as unprecedented changes to the demographics of its application pool over the last several years.[2] Even with variability in the number of applications to emergency medicine (EM) in recent years, EM application numbers remain significantly above what they were 10 years ago.[2,3] Program signaling allows applicants to assign signals to their most desired training programs, so that programs may focus their holistic efforts toward high-yield interview candidates, potentially benefiting both applicants and programs.

Program signaling was implemented in EM via the Electronic Residency Application Service (ERAS) in the 2022–2023 residency application cycle, allowing applicants to send five signals at the time of their residency application submission with instruction to not signal their home or away-rotation institutions.[4] The Association of American Medical Colleges (AAMC) published generic guidance for programs regarding the use of PS only during the interview-offer phase and programs attested to a code of conduct regarding signal usage when opting into the process, including guidance not to use PS in rank order list (ROL) decisions.[5] While data was evaluated by ERAS across all participating specialties, and other specialties have reported their own specialty-specific data, opportunities remained to further investigate questions specific to PS within EM.[6–18] The unique challenges facing EM created an appetite and underscored the need for specialty-specific guidance.

To provide evidence-based guidance, the ERAS Application Working Group, a subset of the Council of Residency Directors in EM (CORD EM) Application Process Improvement Committee, created a survey to address more nuanced EM-specific questions not asked or answered by the AAMC survey. Our objective in this study was to determine how EM program directors (PD) used PS in their application review and ranking practices during the 2022–2023 application cycle, particularly in relation to the proportion of signaled applications received. To our knowledge, no other specialties participating in PS have reported PS utilization data in this manner. We also explored the relationship between program characteristics and the number of signals received, including characteristics not previously studied by the AAMC such as geographic location, program length of training, program environment, and program longevity. Lastly, we investigated the relative importance and utilization of signals in comparison to other residency application elements and in relation to the number of signals received.

Population Health Research Capsule

What do we already know about this issue?
Program signaling (PS) was introduced into the emergency medicine (EM) residency application process in 2022–2023 via the Electronic Residency Application Service.

What was the research question?
How did EM program directors use PS in application review and ranking?

What was the major finding of the study?
52.2% of program directors used PS in holistic review. Other uses varied by proportion of signaled applications.

How does this improve population health?
Understanding PS usage patterns helps inform PS allocation and usage on an individual applicant and program level.

METHODS

Study Design

We used a cross-sectional study design. Participants were PDs in Accreditation Council for Graduation Medical Education (ACGME)-accredited EM residency programs participating in the 2023 National Resident Matching Program Match. The CORD member directory, cross-referenced with the ACGME Accreditation Data System public search website, was used to compile the email distribution list. We edited the list to reflect new PDs when possible (277). The survey was created following a thorough literature review and synthesis of background information. Questions were iteratively reviewed by experts in EM medical education. The survey was further refined after conducting two cognitive interviews with EM residency program leaders and then piloted by several EM educators to assess for clarity of the questions. Data was primarily quantitative. No identifying information was collected. The study was designed to take about 10 minutes to complete. Our survey tool is included in Appendix 1. This study was approved by the institutional review board at the institution of authors TF and TS.

Data Collection

The survey link was distributed via email. We collected data using a confidential and secure web-based (Qualtrics, Provo, UT) survey of EM residency PDs or their designees. Anonymous links were created for each potential respondent and distributed via Qualtrics. As described by Dillman and

colleagues, one week prior to distribution of the survey link, PDs received a brief email introducing the study and informing them that they would receive the study link in the coming week.[19] Participants then received a message containing the survey link. Non-responders received up to three reminder messages over five weeks.

Data Analysis

Data was downloaded from REDCap, hosted at Maine Medical Center, directly into SPSS for Windows v 27 (IBM SPSS Statistics for Windows, IBM Corp., Armonk, NY) statistical software for analysis. We used descriptive statistics to describe the characteristics of study participants' residency training programs. Program practices and experiences around PS were described using numbers and percentages for each categorical variable. We summarized continuous variables using measures of central tendency (mean or median) and dispersion (standard deviation, interquartile range [IQR]). Comparisons between groups for categorical variables were made using chi-square analysis or the Fisher exact test. Comparisons for continuous variables were made using the *t*-test for independent samples or analysis of variance. We accepted a *P*-value of <0.05 as significant. We also computed differences between groups and their associated 95% confidence intervals (CI) and created visual data displays to aid in interpretation.

RESULTS

Program Characteristics

We received 113/277 surveys (response rate 41%). Participants represented diverse geographic regions, with the largest numbers from the Middle Atlantic, East North Central Midwest, and South Atlantic regions (Table 1). Programs represented were most commonly urban, university-based, and three years length of residency training. Faculty at participating programs were largely university or hospital employees, and most programs reporting being founded more than 15 years.

Program Signaling Participation and Applications Received

The majority of respondents participated in the PS component of the ERAS supplemental application during the 2022–2023 residency application cycle (106, 94%). Reasons for non-participation included not signing up in time (three, 2.7%), feeling that it would not contribute to applicant review or interview offer decisions (two, 1.8%), and being a newly approved program (1, 0.9%). Programs interviewed to fill a mean and median of 12 postgraduate year (PGY)-1 spots (range 6–26 spots, IQR 8–15). The number of signals received by participating programs ranged from 2–203, with a mean of 60 and median of 50 (IQR 23–86). Programs reported receipt of between 283–1,400 applications (mean 768, median 772, IQR 600–926). The proportion of applications that were signaled ranged from 0.7% to 26.5% (mean 7.3%, median 6.5%, IQR 3.9–10.1%).

There was a moderate, positive correlation between the number of signals and the number of applications received ($r = 0.581$, $P < 0.001$) and the proportion of signals received increased based upon the number of applications received ($P < 0.001$) as well as the proportion of applications that were signaled ($P < 0.001$). The number of signals received increased as the number of PGY-1 positions increased ($P < 0.001$). Four quartiles were determined for the number of program signals received, the number of applications received, and the proportion of applications signaled (Supplemental Table 1) to allow for further comparison of data as subsequently detailed.

Signals Received by Program Characteristics

The number of signals received differed significantly based on several key characteristics: geographic location, with greater numbers of signals received in coastal regions ($P < 0.01$); program duration, with four-year receiving more than three-year programs ($P < 0.01$); program type, with urban programs receiving the most ($P < 0.01$); program environment, with university-based programs receiving the most ($P < 0.01$); and longevity of programs with programs in existence >15 years receiving the most ($P < 0.01$). Additional detail is provided in Figures 1 and 2 and Supplemental Figure 1.

Signal Utilization

Programs most commonly endorsed using PS as one component of holistic review (59, 52.2%). Additional specific ways that signals were used include the following: as a tiebreaker between two equally qualified candidates (45, 39.8%); as a screening tool (44, 38.9%); to help prioritize the program's wait list or wait list order (31, 27.4%); and to send an interview invitation to every applicant who signaled the program (19, 16.8%). The proportion of applications that were signaled appeared to affect the frequency with which programs endorsed using signals to prioritize the wait list ($P < 0.001$), serve as a tiebreaker ($P < 0.001$), and to send interview invitations to every signaling applicant ($P = 0.03$) (Figure 3). Participants anticipated using PS in the 2023–2024 cycle similarly to their reported use in the 2022–2023 cycle, and similar differences were also noted for anticipated use based on the proportion of applications that were signaled.

Signal Importance

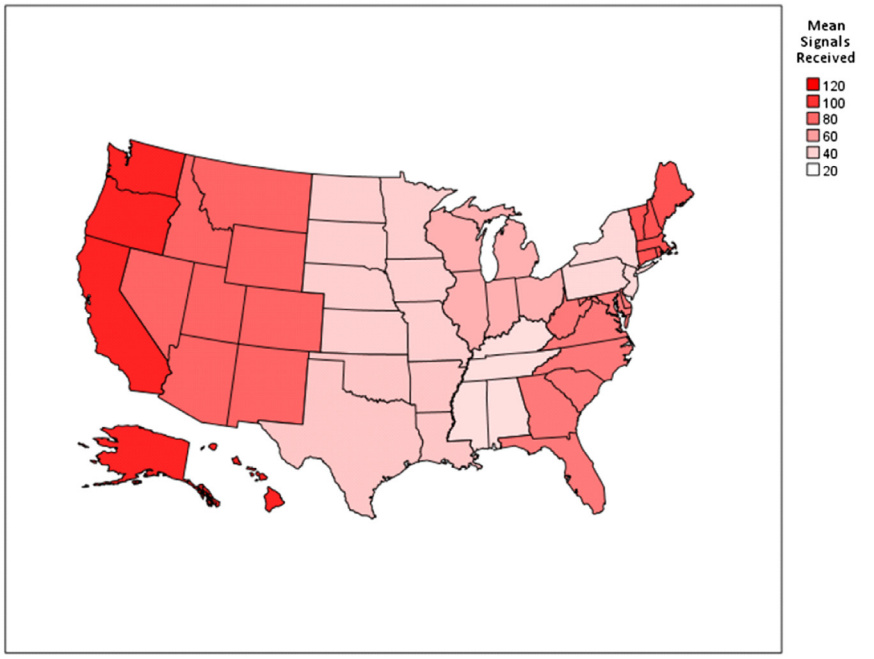
Participants rated the importance of various application elements when considering interview invitations and preparing their program's rank order list (ROL) using a 5-point scale (1 = not important at all, 5 = extremely important) (Table 2). Participants rated the standardized letter of evaluation (SLOE) as the most important element

Table 1. Characteristics of participating residency programs and survey respondents.

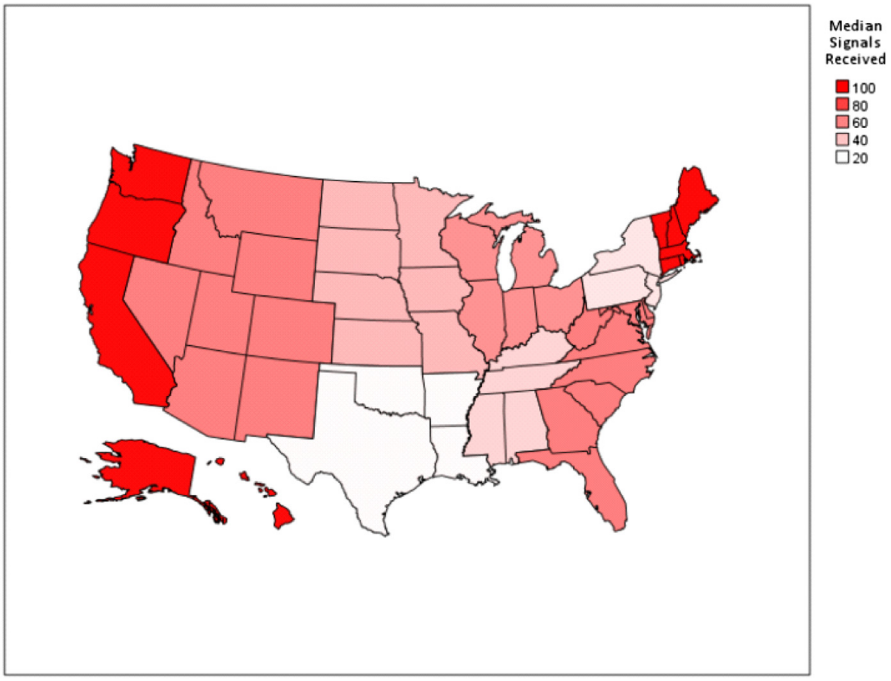
Characteristic	% (*n*)	Comparison to existing program data (percentage of programs)
Professional role		
*Program director	100 (113)	
Geographic region		
Middle Atlantic	24.8 (28)	23.7[a]
East North Central Midwest	20.4 (23)	20.5[a]
South Atlantic	17.7 (20)	19.1[a]
Pacific West	11.5 (13)	10.6[a]
West South Central	11.5 (13)	9.9[a]
New England	5.3 (6)	4.2[a]
Mountain West	4.4 (5)	3.9[a]
West North Central Midwest	2.7 (3)	3.9[a]
East South Central	1.8 (2)	4.2[a]
Program length		
Three years	77.0 (87)	80.6[b]
Four years	23.0 (26)	19.4[b]
Program environment		
Urban	63.7 (72)	Not available
Suburban	30.1 (34)	Not available
Rural	6.2 (7)	Not available
Program type		
University-based	47.8 (54)	35.4[a]
Community-based, university-affiliated	36.3 (41)	46.2[a]
Community-based	15.9 (18)	18.4[a]
Faculty employment model		
University or hospital	73.5 (83)	Not available
Contract management group	18.6 (21)	Not available
Democratic physician-led group	8.0 (9)	Not available
Program longevity		
<5 years	17.7 (20)	Not available
5–10 years	8.0 (9)	Not available
10–15 years	10.6 (12)	Not available
>15 years	63.7 (72)	Not available

**261/277 EM programs participated in PS for 2022–2023. All 277 programs surveyed.*
Middle Atlantic = NJ, NY, PA; East North Central Midwest = IL, IN, MI, OH, WI; South Atlantic = DC, DE, GA, FL, MD, NC, SC, VA, WV, PR; Pacific West = AK, CA, HI, OR, WA; West South Central = AR, LA, OK, TX; New England = CT, MA, ME, NH, RI, VT; Mountain West = AZ, CO, ID, MT, NM, NV, UT, WY; West North Central Midwest = IA, KS, MN, MO, ND, NE, SD; East South Central = AL, MS, KY, TN.
[a]Fellowship and Residency Electronic Interactive Database (FREIDA), https://freida.ama-assn.org
[b]Emergency Medicine Residents' Association (EMRA) Match Database, https://match.emra.org/

when reviewing applications (mean 4.97, 95% CI 4.93–5.00). The SLOEs (mean 4.90, 95% CI 4.83–4.97) and interview day performance (mean 4.81, 95% CI 4.72–4.89) were most important when preparing the ROL. Importance of the presence or absence of a program signal when reviewing applications was a mean of 2.9 (95% CI 2.67–3.13) and median of 3 (2,4). Importance of the presence or absence of a program signal when preparing a ROL was a mean of 2.1 (95% CI 1.87–2.32) and median of 2 (1–3). About 30% of participants (28) endorsed the presence or absence of a program signal as very or extremely important when reviewing applications while 11% (10) rated program signals as being equally important to ROL development.



(A)



(B)

Figure 1. (A) Mean number of signals received by geographic region. (B) Median number of signals received by geographic region. Geographic regions include: East North Central Midwest (IL, IN, MI, OH, WI), East South Central (AL, MS, KY, TN), Middle Atlantic (NJ, NY, PA), Mountain West (AZ, CO, ID, MT, NM, NV, UT, WY), New England (CT, MA, ME, NH, RI, VT), Pacific West (AK, CA, HI, OR, WA), South Atlantic (DC, DE, GA, FL, MD, NC, SC, VA, WV, PR), West North Central Midwest (IA, KS, MN, MO, ND, NE, SD), and West South Central (AR, LA, OK, TX).

We assessed for differences in PDs' relative assessments of various application elements based on the proportion of applications that were signaled (Supplemental Figure 2). As the proportion of applications signaled increased, the proportion of programs endorsing board scores as "extremely important" decreased ($P < 0.01$). As the proportion of applications signaled increased, the proportion of programs endorsing communication before the interview

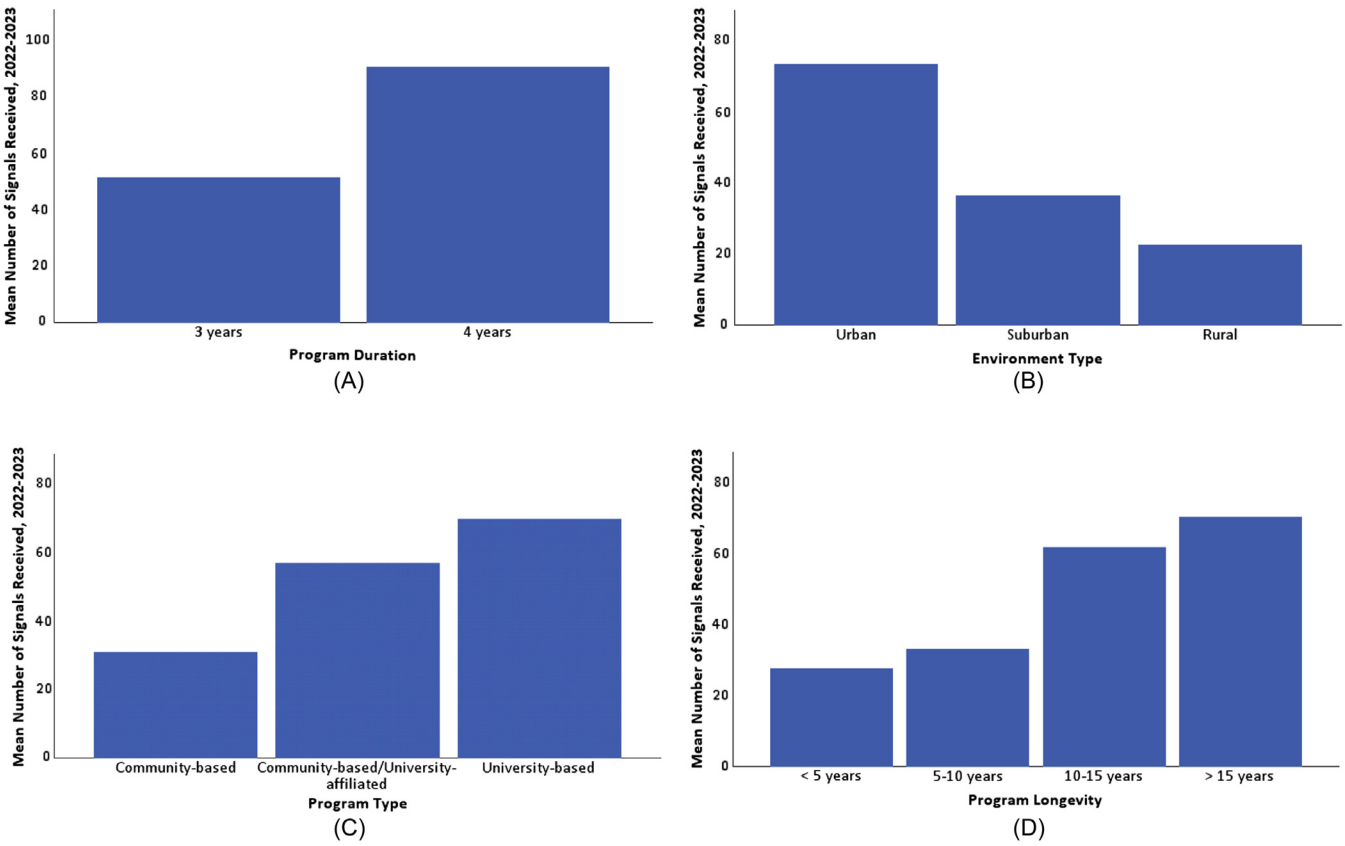


Figure 2. Mean number of signals received by program characteristics. (A) Mean number of signals received by program duration. (B) Mean number of signals received by environment type. (C) Mean number of signals received by program type. (D) Mean number of signals received by program longevity.

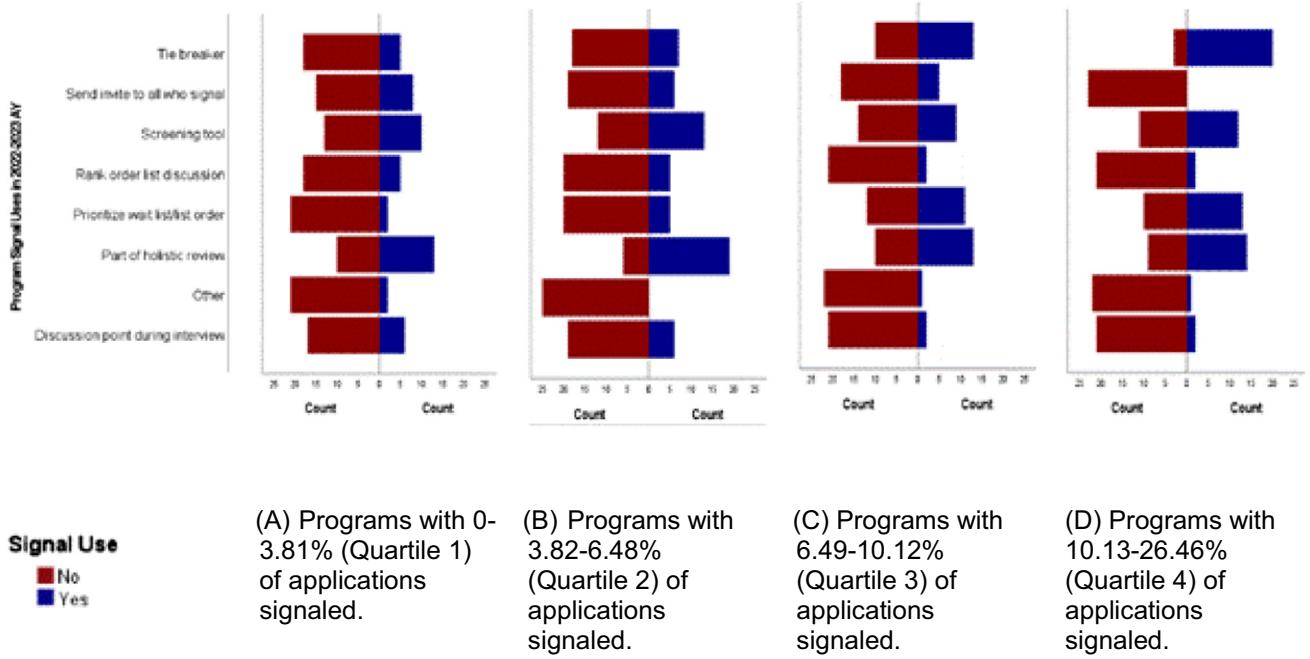


Figure 3. Program signal use in the 2022–2023 academic year by the proportion of applicants signaled.*
*The AAMC Code of Conduct, which programs attest to when signing up to participate in program signaling (PS), specifically prohibits the use of PS in rank-order list discussion and preparation.

Table 2. Importance of application elements.

Application element	Importance when reviewing applications	Importance when preparing rank order list
	Mean (95% CI)	Mean (95% CI)
SLOEs	4.97 (4.93–5.00)	4.90 (4.83–4.97)
Interview day interactions	N/A	4.81 (4.72–4.89)
Prior work or life experiences	3.61 (3.42–3.80)	3.52 (3.32–3.72)
Board scores	3.47 (3.27–3.66)	3.14 (2.93–3.35)
MSPE	3.44 (3.24–3.65)	3.32 (3.12–3.53)
Extracurricular involvement	3.36 (3.17–3.54)	3.25 (3.05–3.45)
Presence or absence of a program signal	2.90 (2.67–3.13)	2.10 (1.87–2.32)
Communication before interview	2.64 (2.42–2.87)	2.89 (2.65–3.13)
Research experience	2.46 (2.27–2.64)	2.43 (2.24–2.62)
Letters of recommendation	2.40 (2.22–2.58)	2.33 (2.15–2.52)

*5 point scale where 5 = extremely important and 1 = not important at all.
CI, confidence interval; *SLOE*, standardized letter of evaluation; *MSPE*, medical student performance evaluation.

as "not important at all" increased while the proportion rating this factor "very important" decreased ($P < 0.01$). Extracurricular involvement increased in importance as the number of applications signaled increased, with a larger proportion of participants rating this aspect of the application "extremely important" as the proportion of applications signaled increased ($P = 0.04$). Programs with the lowest proportion of signaling applicants were more likely to rate research experience as "not important at all" than those who had a larger proportion of applications signaled ($P = 0.02$).

DISCUSSION

Responses to our survey appear to be appropriately representative of programs nationwide with regard to geographic distribution, program length, and program type (Table 1).[20,21] Ranges and median numbers for applications and PS data are similar to ERAS data, again demonstrating that our survey respondents reflected a representative sample of EM programs that participated in PS during the studied application cycle.[6]

For data analysis, we used quartiles based on the percentage of signaling applications a program received to correct for the differences in raw numbers based on program size. With the number of signals allocated to each EM applicant increasing from five to seven for the 2023–2024 academic year, it is reasonable to presume that the raw number and percentage of signaling applicants programs receive will also proportionally increase. This discrepancy may make it more difficult for a program to accurately identify with a given quartile based on this year's application data, but these data should still serve as a rough guide by which programs can assess themselves.

Understanding the relationship between program characteristics and the number of received program signals can be helpful for both programs and applicants. Programs can determine their competitiveness within the context of similar programs, which can be particularly helpful in the current EM match environment with a changing applicant demographic pool and many programs going unmatched over the past few years.[2] Providing programs with a barometer against which to measure their own demographics and proportion of signaled applicants early in the application cycle can help guide how they incorporate program signals into their approach and more effectively select applicants who will be highest yield for their programs. By understanding signaling trends as related to program characteristics, advisors and applicants may be able to strategically determine the best approach for allocating signals to maximize each signal's impact.

In our study, we noted that the Pacific West and New England regions demonstrated the highest mean and median signal numbers. In contrast, programs in the East South Central, Mid-Atlantic, West South Central, and West North Central Midwest received fewer signals. It is reasonable to speculate that many of these patterns reflect overall population density patterns, suggesting local preferences that mirror the US population. This hypothesis aligns with our data, which showed that more urban (likely more population-dense) programs received a higher proportion of signals. The only region that does not fit this hypothesis is the Mid-Atlantic region, which is the most densely populated in the country, but we suspect the very high EM program density in this region likely contributed to program signal dilution, leading to lower signals per program.

On average, four-year programs received a higher proportion of signaling applicants than three-year programs. While program length itself may be a driver of this, it may also be due to other confounding features more commonly associated with four-year programs, including urban location, university affiliation, and program duration and stability. Ultimately, our data was unable to discern this difference. Programs with the lowest proportion of signaling applicants were more likely to be smaller, rural, and not academically affiliated. These programs were more likely to rate research experience as "not important at all." We suspect that these smaller, more community-oriented programs may be less research-focused in their missions and, therefore, emphasize research less in their applicant selection. Applicants may be able to use this information to target their signals depending on their interests.

It seems intuitive that the proportion of signaling applicants a program receives would affect how that program values and uses the signal, but to our knowledge this is the first data to demonstrate that effect. When examining signaling use among programs separated into quartiles based on the proportion of signaling applicants, significant differences emerged. Programs that received lower proportions of signaling applicants were more likely to report offering interviews to all signaling applicants while those with the highest proportion of signaling applicants were more likely to incorporate signals as a screening tool or to help prioritize the program's wait list or wait-list order.

By asking programs to rate the importance of various application elements, we hoped to gain an understanding of the relative importance of PS in relation to interview offers and ROL creation. Receiving a program signal in orthopedics was ranked among the most important factors in resident selection for interview.[13] While a successful sub-internship at the PD's institution and letters of recommendation were the highest-ranked criteria for resident selection for interview at urology programs, 81% of urology PDs reported that a lack of a signal would negatively impact interview offer chances for an applicant.[18] In our study, program signals were not shown to hold as much weight as in orthopedics or urology. Program signals were only rated as more important than narrative letters of recommendation, pre-interview communication, and research experience.

How an applicant performs clinically (SLOEs, Medical Student Performance Evaluation) is understandably most important, with PS intended to be only one small part of the holistic application review.[22] Students can be reassured that the traditionally valued portions of the EM application retain their importance well above the value of a program signal, and programs across all quartiles are interviewing and ranking students who did not send them a signal.

Analyzing this data in a more granular fashion, we did observe some significant differences in the relative importance of residency application elements between quartiles. As the proportion of signaling applicants increased, the proportion of participants endorsing board scores as "extremely important" decreased. This discrepancy may speak to the intended ability of PS to mitigate the use of filtering behavior. Programs with smaller proportions of signaling applicants may continue to seek out strategies to stratify their applicant pool to better allocate their holistic review efforts, such as using board score filters. Programs with a higher proportion of signaling applicants, on the other hand, may not feel this same pressure. Alternatively, it is possible that having been prompted by the introduction of PS to investigate programs before applying, applicants may strategically have chosen to target their signals to programs that advertised a lack of board score cutoffs because their score fell below stated cutoffs at other programs or because they valued programs that do not emphasize standardized test scores.

Our data also demonstrates that as the proportion of signaling applicants increased, the proportion of respondents rating pre-interview communication as "extremely important" decreased and the proportion of respondents rating pre-interview communication as "not important at all" increased. This trend suggests that the signal is serving its intended purpose of allowing the applicant to meaningfully express interest, obviating the need for additional, extra-application communication, lessening the burden for both applicants and programs. It also suggests that PS reduces the impact of other communication from applicants.

The AAMC guidance was consistent in its messaging that program signals were only to be used during the application review and interview-offer portion of the application cycle. It is worth noting that despite all programs having attested in the code of conduct not to use PS in the consideration of ROL placement, 11% of programs reported program signals to be very important to the ROL development process. The 2022–23 AAMC PD survey found similar results among PD respondents from all specialties.[6] Program directors may be extrapolating that a student who signaled is likely to be a higher probability match than a student who did not send a signal. This use presumes that student preference will not be significantly affected by their experiences engaging with programs throughout the interview season and is at risk of being flawed logic. However, it is important that applicants be aware that signals may be used by PDs in this manner and should take this into consideration when choosing where to signal.

Participation of EM programs in PS remained robust for the 2023–2024 cycle, with 278 of 279 programs participating and 97.5% of applicants participating (email communication from AAMC ERAS Pilot Administration Director, Jayme Bograd, January 2024).[24] We hope that

this data helps inform programs and applicants on a more nuanced approach to PS in the EM residency application process.

LIMITATIONS

Respondents (113) compared to the total number of ACGME-accredited EM residency programs (277) was limited. The PDs who chose to respond may differ from those who did not concerning their PS experience. Forty-six percent of EM programs did not fill in the 2023 Main Residency Match.[25] Our survey was distributed in the weeks that followed. The PDs experiencing a difficult Match cycle may have been more or less inclined to fill out a survey regarding the residency application process. University-based programs were over-represented. Community-based, university-affiliated programs were under-represented. The 11% of programs that reported using signals as part of their ROL discussions may be an underestimate as other programs may not have been comfortable disclosing behavior that was knowingly in violation of the code of conduct.

CONCLUSION

This study provides detailed data and patterns of signal use yielding insights into program signaling in EM's inaugural year for both programs and applicants. Our data provides a more nuanced understanding of signal utilization across a spectrum of EM programs in a way that allows individual programs to go beyond the general AAMC recommendations and compare their approach to that of programs with similar characteristics. Identifying patterns of signal use based on program characteristics can also inform advising for students deciding on how to best allocate their signals. As EM continues to navigate fluctuations in its applicant numbers and shifting demographics of its applicant pool, providing insight to guide signal use and utilization can help pave a path forward for the specialty toward the goal of more efficiently finding the right applicant for the right program.

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Emergency Medicine Milestones Final Ratings Are Often Subpar

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Background: The emergency medicine (EM) milestones are objective behaviors that are categorized into thematic domains called "subcompetencies" (eg, emergency stabilization). The scale for rating milestones is predicated on the assumption that a rating (level) of 1.0 corresponds to an incoming EM-1 resident and a rating of 4.0 is the "target rating" (albeit not an expectation) for a graduating resident. Our aim in this study was to determine the frequency with which graduating residents received the target milestone ratings.

Methods: This retrospective, cross-sectional study was a secondary analysis of a dataset used in a prior study but was not reported previously. We analyzed milestone subcompetency ratings from April 25–June 24, 2022 for categorical EM residents in their final year of training. Ratings were dichotomized as meeting the expected level at the time of program completion (ratings of ≥3.5) and not meeting the expected level at the time of program completion (ratings of ≤3.0). We calculated the number of residents who did not achieve target ratings for each of the subcompetencies.

Results: In Spring 2022, of the 2,637 residents in the spring of their last year of training, 1,613 (61.2%) achieved a rating of ≥3.5 on every subcompetency and 1,024 (38.8%) failed to achieve that rating on at least one subcompetency. There were 250 residents (9.5%) who failed to achieve half of their expected subcompetency ratings and 105 (4.0%) who failed to achieve the expected rating (ie, rating was ≤3.0) on every subcompetency.

Conclusion: When using an EM milestone rating threshold of 3.5, only 61.2% of physicians achieved the target ratings for program graduation; 4.0% of physicians failed to achieve target ratings for any milestone subcompetency; and 9.5% of physicians failed to achieve the target ratings for graduating residents in half of the subcompetencies. [West J Emerg Med. 2025;26(1.2)11–14.]

INTRODUCTION

With the advent of the Next Accreditation System (NAS), the Accreditation Council for Graduate Medical Education (ACGME) introduced a new assessment process called the "milestones."[1] The milestones are objective behaviors that reflect elements of the major competencies (eg, patient care, systems-based practice) in thematic domains called "subcompetencies" (eg, emergency stabilization, patient- and family-centered communication). The milestone scale uses nine ratings from 1.0, 1.5, 2.0, 2.5, etc, to 5.0. The scale is predicated on the assumption that a rating (level) of 1.0 corresponds to an incoming emergency medicine (EM)-1 resident and a rating of 4.0 is the graduation "target," albeit not a graduation expectation or requirement. According to the ACGME: "Level 4 is designed as a graduation *goal* but *does not* represent a graduation *requirement*."[2] The EM milestones have been used exclusively as a formative assessment by the ACGME. Likewise, a physician's EM

milestone ratings are not considered when determining the eligibility of a physician to take the American Board of Emergency Medicine (ABEM) written qualifying examination.

The EM milestones were introduced in 2012, and the first ratings were reported in 2013.[3] The EM milestones were revised in 2021, resulting in 22 subcompetencies. Since 2012, substantial validity evidence for the EM milestones has been accumulated.[4–10] A resident's milestone ratings are usually assigned by clinical competency committees (CCCs). Some subcompetency ratings are below target levels. Often, the subcompetency ratings assigned by the CCCs are lower than the ratings that residents give themselves.[11] The milestones were initially designed to have a rating of 4.0 as the target for a resident completing an EM residency.[9] Aggregate EM milestones are reported annually by the ACGME.[12] These data and other reports suggest that a substantial number of graduating residents are not achieving a level 4 rating in many milestone subcompetencies.

We undertook this study to determine the frequency with which graduating residents received the target milestone rating.

METHODS

Study Design

This retrospective cross-sectional study was a secondary analysis of an already de-identified dataset used in a prior study.[13] Our current study was deemed exempt from human subject research by the Western-Copernicus Group Institutional Review Board. The dataset available to the investigators did not include physician or program characteristics that would allow a more detailed analysis.

Study Setting and Population

We analyzed milestone subcompetency ratings from Spring 2022 for categorical EM residents in their final year of training. These milestone ratings were submitted between April 25–June 24. This ratings report used EM Milestones 2.0, which included 22 subcompetencies. The dataset had been provided earlier to ABEM by the ACGME as part of the routine EM milestones secure data-sharing process.

Measurements or Key Outcome Measures

The primary measure was the number of subcompetencies for which physicians failed to achieve a target rating of 3.5 at the time that the Spring milestone ratings were submitted to the ACGME. Because the ratings were submitted between April and June prior to residency completion, and the CCC could have determined the ratings even earlier than that, an expected rating for purposes of the study was modified to be 3.5 rather than 4.0. Doing so assumed that the resident would achieve a rating of 4.0 over the remaining weeks to months of residency training. We determined the number of physicians who did not achieve the target rating for the subcompetencies (from 0 subcompetencies to all 22 subcompetencies).

Data Analysis

Ratings were dichotomized as meeting the target level at the time of program completion (≥3.5) and not meeting the target level at the time of program completion (≤3.0). We calculated the number of competencies for which a target rating was not achieved.

RESULTS

In Spring 2022, there were milestone ratings for 2,637 residents in the Spring of their last year of training in 279 EM residencies. There were 1,613 residents (61.2%) who achieved a rating of ≥3.5 on every subcompetency and 1,024 residents (38.8%) who failed to achieve a rating of ≥ 3.5 on at least one subcompetency. There were 250 physicians (9.5%) who failed to meet half of their target subcompetency ratings. There were 105 residents (4.0%) who failed to meet the target rating (ie, rating was ≤3.0) on every subcompetency (Table).

Table. The frequency of emergency medicine residents receiving target milestones ratings lower that 3.5 in Spring 2022 (n = 2,637).

Number of ratings lower than 3.5	Number of terminal-year residents	Percent of total
0	1613	61.2
1	235	8.9
2	155	5.9
3	97	3.7
4	77	2.9
5	68	2.6
6	39	1.5
7	35	1.3
8	21	0.8
9	22	0.8
10	15	0.6
11	10	0.4
12	15	0.6
13	16	0.6
14	19	0.7
15	12	0.5
16	9	0.3
17	15	0.6
18	11	0.4
19	19	0.7
20	14	0.5
21	15	0.6
22	105	4.0

LIMITATIONS

First, the actual level of subcompetency achievement at graduation was imprecisely known. We chose a rating of ≥3.5 to represent the performance target, given that the milestone ratings were provided prior to the completion of the program. Using a rating of 4.0 to be assigned two months prior to graduation would likely underestimate subcompetency achievement and a score of 3.5 at two months prior to program completion would likely overestimate subcompetency achievement. Anticipating that all residents with a rating of 3.5 would achieve a rating of 4.0 within weeks was a benevolent assumption. Second, demographic data on residents (eg, gender) and program characteristics (eg, duration of training) were unavailable to the investigators. Although this lack of additional information limited our ability to determine factors associated with the ratings, we believe that the findings are sufficiently significant on their merit and warrant additional investigation.

Third, we did not correlate poor subcompetency ratings with program extension or remediation, thus limiting the opportunity to gather any evidence of predictive or consequential validity. It is possible that nearly every physician who did not achieve a rating of ≥3.5 on nearly half of the milestone subcompetencies underwent remediation. Fourth, the ratings are assigned by CCCs. The structures of, and information used by CCCs, vary by EM residency.[14,15] We did not attempt to determine the reliability or accuracy of the individual ratings. Moreover, we did not examine the potential impact of bias in the ratings. Prior studies suggested that women were assigned lower performance ratings.[16,17] Sixth, the ratings used for this study were from the first year of the EM Milestones 2.0. Although there was a degree of acclimation in developing facility with the EM Milestones 1.0, it is likely that the same degree of unfamiliarity would be less with the most recent version. The degree to which the continued use of EM Milestones 2.0 will change rating trends is unknown.

DISCUSSION

This study is the first in EM to demonstrate the degree to which physicians completing EM residencies are not achieving target subcompetency ratings. These data showed that of the 2,637 residents in their last year of training, nearly one in ten failed to meet target ratings for half of the EM subcompetencies. A similar finding was reported for physicians completing pediatric EM fellowships.[18] However, that report used a target rating of 4.0, not 3.5 as in our study. Consequently, 67% of pediatric EM fellows did not attain a rating of at least 4.0 for at least one subcompetency.

A physician should be able to graduate from residency without scoring 4.0 on all 22 subcompetencies. In fact, all 4.0 ratings (a straight-line score) would be highly improbable.[19] Consider the hypothetical situation that would result from the milestones being used in a summative manner to determine ABEM board eligibility. If residents were required to have no more than six subpar (ie, <3.5) milestone ratings (more than one-fourth of the subcompetencies), then 353 residents (13.4%) in their final year of training would not be eligible to take the ABEM written qualifying examination. Given the intent of the milestones as a formative instrument, ABEM maintains the position that the milestones should not be used as a summative determinant of board eligibility.

The rate of program extension by physicians beyond a scheduled graduation date has been reported to be approximately 8.5%.[13] These extensions include physicians undergoing academic remediation, as well as program extensions due to a personal leave of absence. The prevalence of physicians not meeting half of the target subcompetency ratings was 9.5%. Based on these findings, there were physicians who failed to meet at least half of the EM milestone subcompetencies yet were deemed competent to practice autonomously as attested by the program director. This likelihood does not challenge the construct validity of the milestones, nor does it suggest that the target is too high. In a fact, a prior validity study by Korte et al used program director survey data to verify the appropriateness of the target ratings.[9]

In this study we did not analyze the impact of training length (EM1-3 vs EM1-4). However, a review of mean scores was undertaken in a prior investigation that used the same study period.[13] The scores suggest that residents in EM1-3 programs tended to have higher scores through the postgraduate years (PGY) 1–3. For example, in the PGY-3 year, residents from EM1-3 programs had a mean rating of 3.51 (95% confidence interval [CI] 3.50–3.53) and residents from EM1-4 programs had a mean rating of 3.07 (95% CI 3.05–3.09), while EM4 residents had a mean rating of 3.67 (95% CI 3.65–3.69).

This analysis is an initial exploration into a more thorough investigation of the final milestones rating that an EM resident receives. The current study does not identify variable impact within demographic groups, nor does it provide any indices of predictive validity. Given the findings of this analysis, a more thorough analysis of the milestones should be undertaken to determine their psychometric qualities and subsequent utility in the field. Given the use of the milestones as a formative evaluation system, it should not be used to make summative decisions such as the determination of ABEM board eligibility. A more structured, valid, and reliable process for making the summative determination that a physician has demonstrated the necessary competencies to practice safely and independently is advisable. Moreover, such a detailed summative process could also be used to make a confident determination that a physician is eligible for board certification. This process would be easily accommodated in a model of competency-based medical education.

CONCLUSIONS

Many physicians complete an EM residency without meeting a target rating for a graduating resident in up to half of the EM milestones. Some residents (4%) did not meet a target rating in any milestone. These findings support the continued use of the milestones as a formative instrument, rather than a tool to determine board eligibility.

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Emergency Department Slit Lamp Interdisciplinary Training Via Longitudinal Assessment in Medical Practice

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Introduction: Eye emergencies make up nearly 3% of US emergency department (ED) visits. While emergency physicians (EP) should diagnose and treat these ophthalmologic emergencies, many trainees report limited ocular exposure and insufficient training throughout their residency to confidently conduct a thorough slit-lamp exam.

Methods: We created an interdisciplinary, simulation-based mastery learning (SBML) curriculum to teach emergency attending physicians how to operate the slit lamp with multimodal learning methodology at a tertiary academic center. The EPs first demonstrate their initial slit-lamp competency with a 20-item checklist, and they then review the necessary curricular content to pass their independent readiness test before completing their in-person teaching and demonstration session with an ophthalmology attending to demonstrate procedural mastery (minimal passing score >90%).

Results: Fifteen EPs were enrolled; all completed the final exam of the curriculum. The pre- and post-curriculum checklist scores increased by an average of seven points ($P = .002$); 86.7% of EPs felt confident in completing a slit-lamp exam after the curriculum, compared to 20% at the beginning. Five of 15 reported teaching learners within the two-month post-curricular period, ranging from 5–30 students. The hands-on teaching was the most positively reviewed element of the curriculum.

Conclusion: The SBML program successfully trained EPs on performing a comprehensive slit-lamp exam with promising results of downstream education to junior learners. We encourage other institutions to leverage SBML as a teaching modality for procedural-based training and advocate cross-discipline education initiatives. [West J Emerg Med. 2025;26(1.2)15–24.]

INTRODUCTION

The slit-lamp[1] (Figure 1A) is a microscope that allows for a detailed examination of the anterior eye segment using light beam manipulation. The slit-lamp enables physicians to diagnose anterior ophthalmic pathologies such as corneal injuries, iritis, hyphema, hypopyon, and foreign bodies[2]; furthermore, it is essential for performing detailed ophthalmologic exam techniques such as lid eversion, fluorescein examination, and foreign body removal.[3] The Wood's lamp[4] (Figure 1B), in contrast, is a handheld device often used to characterize skin pigmentation, dermal infections, and macroscopic infections with a built-in magnifying lens and ultraviolet (UV) light. The UV capabilities can highlight fluorescein staining during external ocular exams to assess corneal pathologies at lower magnification. While the Wood's lamp offers a less detailed examination than the slit lamp, it is a more portable diagnostic tool for larger ocular lesions, foreign bodies, or

specific reaction to fluorescein staining and meets the needs of the emergency physician (EP) under certain situations.

Eye emergencies make up nearly 3% of US emergency department (ED) visits, the most common of which are traumatic.[5,6] The most common eye injury evaluated in the ED is corneal abrasion (superficial injury to the cornea) and eyelid laceration. Such injuries are best viewed under high-field magnified viewing using the slit lamp to assess for concomitant injuries or co-infections such as corneal ulcers, hypopyon/endophthalmitis, retained foreign body, full thickness corneal laceration, globe ruptures, and seidel testing.[7] Ocular emergencies such as traumatic globe rupture, ocular foreign body, closed-angle glaucoma, and endophthalmitis are visible only using the slit lamp, and fall within the EP's scope of practice for diagnosis, triaging, and management.[8] Mismanaged ophthalmic emergencies can result in inappropriate consultation, excessive testing, financial burden, and even irreversible vision loss.[9] Despite the significance and frequency of ocular emergencies across the US, many EPs are not confident performing a detailed ophthalmic exam.[10]

Previous literature has found EPs receive fewer than 10 hours of ophthalmic education during residency with low confidence in performing a comprehensive ophthalmic slit-lamp exam.[11] Ophthalmic education through clerkships and didactics in medical school is also in decline, leading to the unpreparedness of incoming residents before any formal residency training.[11,12] However, it is important that EPs be confident in using the slit lamp to appropriately triage and manage ocular emergencies as part of the Accreditation Council for Graduate Medical Education (ACGME) Emergency Medicine (EM) Milestones Patient Care domain (PC8) – General Approach to Procedures, which designates a set of sequential milestones for overall procedural competency, not focusing on a specific list of procedures.[13]

The optimal learning environment for adult learners to perform a technically challenging procedure should incorporate elements from both the mastery learning model and rapid cycle deliberate practice (RCDP). The mastery learning model ensures that students can master a topic if they receive unlimited time and support in learning and reviewing material until mastery proficiency is reached. Meanwhile, the RCDP model ensures learners can practice skills repetitively while receiving brief, interspersed feedback to achieve a designated proficiency level before proceeding to the next task.[14,15–17] Within medical education, simulation-based mastery learning (SBML) models have been successfully implemented across various specialties, such as emergency medicine, general surgery, critical care, and gastroenterology.[18,19,20] In light of successful, smaller scaled studies on the effectiveness of slit-lamp training within undergraduate medical education, we propose a SBML procedural training curriculum that can enable adult learners to conduct deliberate performances of intended cognitive or psychomotor skills in sequential order with a repetitive skills assessment.[15,21,22] Specific, informative feedback will enable sustained performance improvement to achieve slit-lamp mastery.[23] Our goal was to design a pilot interdisciplinary course that could teach EPs to complete a comprehensive slit-lamp exam in diagnosing common anterior eye pathology.

METHODS

Our study, Emergency Department Slit Lamp Interdisciplinary Training via Longitudinal Assessment in Medical Practice (ED SLIT LAMP), is a multicentered, collaborative project that leverages the conceptual frameworks of the mastery learning model and RCDP to ensure proficiency in conducting a comprehensive slit lamp exam. It also serves as a scaffold for deconstructing barriers in traditional siloed medical practices and leads to improved patient care, knowledge synthesis, and resource utilization of our consulting services. The study was conducted at Thomas Jefferson University (TJUH) and the Wills Eye Hospital (WEH) from 2021– 2023. The hospitals with their respective EDs, are 0.2 miles apart, with staff from each institution working as consultants at the other; WEH residents function as ophthalmology consultation for the TJUH ED, while TJUH EPs function as overnight medical emergency

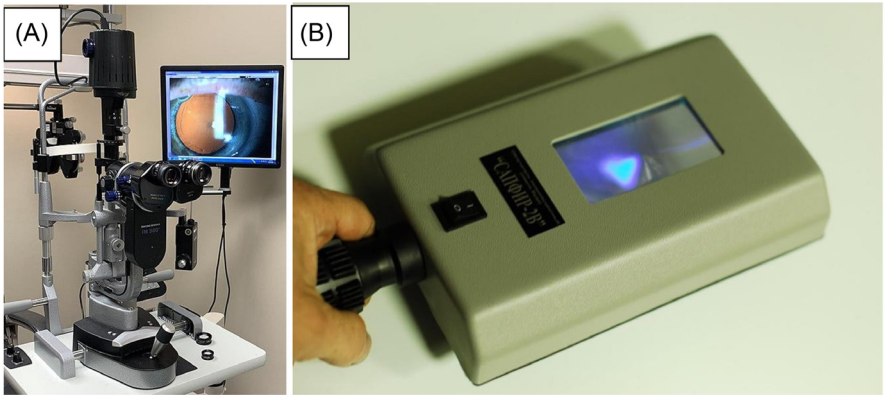

Figure 1. Slit lamp (A) and Wood's lamp (B).

consultants at the WEH ED. The geographic and relationship proximity created ideal conditions to develop and pilot a procedural skill competence SBML curriculum.

Emergency physicians were selected as ideal learners due to their level of training and unique teaching responsibilities. Using the TJUH ED listserv we recruited eligible participants and offered staggered financial incentives. For this pilot study, we required a minimum of 12 participants to meet 5% type 1 error and 80% power based on score improvement from baseline testing to post-testing, as referenced by Miller at al.[24] The ED SLIT LAMP study leveraged talents from content and education experts from both institutions to create an interdisciplinary procedural teaching curriculum. The success of a traditional SBML curriculum is linked to the learners' skill acquisition. Our study expands this measure to include interdisciplinary collaboration, demonstrating the successful alignment between educational and patient-centered goals that benefit both departments. To evaluate the curriculum, we employed all four levels of the Kirkpatrick model. Using pre- and post-test Likert scale questionnaires, our measurement of success included improved learner confidence (level 1), knowledge acquisition (level 2), willingness of learners to incorporate their skillset in clinical practice (level 3), and dissemination of this knowledge to junior learners (level 4). Any curricular feedback and improvements were extracted for future curricular iterations.

A needs-based analysis conducted at TJUH ED revealed EPs desired hands-on slit-lamp education and training on identifying anterior segment ophthalmic complaints. Since ophthalmology is a recognized component of the American Board of Emergency Medicine exam content, we constructed the pre-test clinical content based on critical and common ocular diagnoses, the most common WEH ED ophthalmology discharge diagnoses, and clinical identifications deemed "can't miss" by the ED and ophthalmology department.

All curricular contents (lecture materials, video recording, pre-post-post assessments, study surveys, mastery learning checklist) were created by the principal investigator [XCZ] with ophthalmology co-investigators consultation [CC, MEL] based on targeted needs assessment. These materials underwent sequential review by select experts at WEH and were modified sequentially until a consensus was reached. The minimal passing checklist score was determined to be 90%, based on combined determination from ophthalmologist experts at WEH and similar threshold determined by Miller et al.[24] Each curriculum assessment (Appendix A) was constructed to mirror the natural knowledge, skills, and attitude progression from the ACGME EM Milestones Patient Care Domain (PC8). Due to the multifaceted nature of EM, there is no specific procedural milestone for performing a slit-lamp exam, as described in detail in the ACGME Ophthalmology PC1: Data Acquisition - Basic Ophthalmology Exam and Testing (Level 1).[13] However, the EM PC8 milestones provide structured language applicable to many ED procedures and advanced device-assisted medical examinations (ie, slit-lamp exam). Please see Table 1 for the correlation between the EM milestone and ED SLIT LAMP assessments.

The longitudinal curriculum included four unique time points (Time 0–3) of intervention staggered over six months (Appendix A, Appendix B). At Time 0, participants completed an in-person baseline slit-lamp exam that was video-recorded and reviewed by two independent investigators [XCZ] [MEL]. At Time 1, the participants gained access to an asynchronous learning packet that consisted of a PowerPoint presentation on common ED eye complaints, digital library links to the WEH Manual, slit-lamp checklist, and a video recording of a comprehensive slit-lamp examination.[25] The participants also gained access to an independent readiness assessment (IRAT), which was required to be completed within 30 days with a minimum score of 90% before proceeding to the next in-person phase of the study (Appendix A).

Upon achieving the passing IRAT score, they were invited to participate in the Time 2 (in-person) SBML portion of the study where they were to complete an in-person demonstration of a comprehensive slit-lamp exam by a board-certified ophthalmologist [CC] on a standardized patient volunteer. Following the demonstration, participants were given unlimited time for RCDP with brief, interspersed feedback under the observation and teaching from the ophthalmologist. Participants were required to complete a minimum 18 of 20 checklist items to achieve mastery (Appendix B). Upon completing the final checklist, the participants were asked to complete a course evaluation and learner confidence survey (Appendix C) with Likert scaling, subjective commentary, and a validated 5-item Critical Incidence Questionnaire (CIQ) for curricular improvement. Given the unpredictability nature of the "unlimited attempts" at Time 2, all participants were scheduled at two-hour intervals to allow for device preparation, one to two re-attempts, debriefing, survey completion, and general troubleshooting. At Time 3, participants completed a 60-day post-examination survey, assessing their ocular knowledge, slit-lamp confidence, clinical teaching opportunities, and relevant interprofessional relationships.

We used a Wilcoxon signed-rank test to differentiate the checklist scores between the curricular intervention by incorporating collected paired data before and after the training, median and interquartile range values of subtotal scores at two-time points.[26] We used McNemar's test to comparing each categorical sub-score (Yes/No) by time points and corresponding *P*-value within the same population.[27] The descriptive summaries of survey questions at Time 0, Time 2, and three-month follow-up were analyzed using Bonferroni adjusted *P*-values (multiplying *P*-value

Table 1. Corresponding emergency department slit-lamp assessments to ACGME EM* milestone general approach to procedures.

ACGME EM milestone PC8	Bolded PC8 elements relatable to performing a slit lamp exam	Correlating ED SLIT LAMP assessments
Level 1	Identifies indications for a procedure and pertinent anatomy and physiology. Performs basic therapeutic procedures (eg, suturing, splinting)	Appendix A–Part II (clinical image examination)
Level 2	Assesses indications, risks, benefits, and alternatives and obtains informed consent in low- to moderate-risk situations. Performs and interprets basic procedures, with assistance. Recognizes common complications	Appendix B–Part I (slit lamp technical) Appendix B (final checklist)
Level 3	Assesses indications, risks, and benefits and weighs alternatives in high-risk situations. Performs and interprets advanced procedures, with guidance. Manages common complications	Appendix A–Part III (ophthalmology exam mix-n-match
Level 4	Acts to mitigate modifiable risk factors in high-risk situations. Independently performs and interprets advanced procedures. Independently recognizes and manages complex and uncommon complications	Appendix B (final checklist)
Level 5	Teaches advanced procedures and independently performs rare, time-sensitive procedures. Performs procedural peer review	Appendix C–ED SLIT LAMP surveys

**ACGME EM*, Accreditation Council for Graduate Medical Education Emergency Medicine; *PC*, patient care; *ED SLIT LAMP*, Emergency Department Slit Lamp Interdisciplinary Training.

from Wilcoxon signed-rank test by the number of multiple tests, doubling the *P*-values), which was directly compared to the pre-specified 5% significance level. All statistical analyses were performed using R 4.1.2 (R Foundation for Statistical Computing, Vienna, Austria).[28]

This study was approved by the institutional review board at Thomas Jefferson University Hospital (TJUH) in Philadelphia, PA. Informed consent was obtained from participating physicians. This study was funded by the Center for Faculty Development and Nexus Learning Pedagogy Grant at Thomas Jefferson University.

RESULTS

Fifteen EPs (six females and nine males) were enrolled in ED SLIT LAMP during the two-year period; none were lost to follow-up. All participants were board-certified EPs with an average clinical experience of 7.8 years post-residency graduation. All EPs completed the final exam of the curriculum in one attempt and all under 60 minutes.

Table 2 lists the 20 steps of the slit-lamp exam curriculum checklist, comparing participant results from recorded slit-lamp attempts (Time 0) to the final in-person assessment (Time 2). The intra-class correlation in test scores between EPs and ophthalmologists at Time 0 (2 raters) was 0.98. We found a significant increase between the checklist scores before and after the education initiative, 12.0 to 19.0, $P = 0.002$.

The most notable differences between the pre- and post-curricular intervention were as follows: 1) instructing the patient to close their eyes while powering up and positioning the patient in the slit lamp with the forehead touching the horizontal bar and chin in the chinrest ($P < 0.001$); 2) adjusting the microscope 90 degrees to facial plane with illumination set at a 45-degree angle ($P = 0.008$); 3) performing an anterior chamber evaluation ($P = 0.002$); 4) looking for cells and flare ($P = 0.021$); and 5) placing fluorescein in the inferior fornix of the eye ($P = 0.031$). The most missed steps at the baseline exam were: 1) applying a transparent face shield (26.7%); 2) instructing patients to close their eyes when the machine was turned on (26.7%); 3) looking for cells and flare (26.7%).

Figures 2 and 3 illustrate learners' confidence in performing and teaching the slit-lamp exam at the beginning of the study (Time 0), immediately after achieving procedural mastery (Time 2), and two months later (Time 3). Figure 4 illustrates the learners' likelihood in teaching the slit-lamp exam at Time 0 and Time 2. Before participating in the slit-lamp curriculum, 73% of EPs also reported rarely or never performing a slit-lamp exam, while 80% of EPs reported sometimes or often using a Wood's lamp for ocular complaints. Only 20% of EPs reported feeling confident in performing and teaching a comprehensive slit-lamp exam, while 67% of EPs reported feeling confident in using and teaching Wood's lamp for ocular examination.

After completing the slit-lamp curriculum (Time 2), 86.7% of EPs reported feeling confident performing a comprehensive slit-lamp exam for ocular complaints, and 73.3% were more confident in teaching residents how to perform a slit-lamp exam. Most EPs strongly agreed that the ED SLIT LAMP curriculum helped them perform an

Table 2. Descriptive summary of checklist evaluation at pre- and post-curricular and comparison between time points.

Checklist item	Performed	Time 0, N(%) (N = 15)	Time 2, N(%) (N = 15)	*P*-value from exact McNemar's test
1 - Identify slit lamp anatomy.	Yes	13 (86.7%)	15 (100%)	0.50
2 - Apply transparent face shield over the slit lamp (COVID).	Yes	4 (26.7%)	15 (100%)	<0.001
3 - Sanitize forehead and chin rest for the patient.	Yes	5 (33.3%)	14 (93.3%)	0.004
4 - Apply topical tetracaine/proparacaine on patient's eyes.	Yes	8 (53.3%)	12 (80.0%)	0.22
5 - Unlock instrument base and shift by pulling toward you.	Yes	15 (100%)	15 (100%)	NA
6 - Adjust eye pieces for your interpupillary distance and refractive error.	Yes	10 (66.7%)	14 (93.3%)	0.22
7 - Adjust table height and/or chair(s) - neither patient nor examiner should be hunched over.	Yes	12 (80.0%)	14 (93.3%)	0.50
8 - Instruct patient to close eyes while you power up by turning on the light source at low voltage setting and focus on right eyelid. Position patient in slit lamp with forehead touching the horizontal bar and chin in the chin rest.	Yes	4 (26.7%)	15 (100%)	<0.001
9 - Set magnification on lowest settings (10x to 12x), illumination at largest aperture and widest slit beam.	Yes	12 (80.0%)	15 (100%)	0.25
10 - Adjust chin rest so the patient is sitting comfortably with their chin on the chinrest and their forehead against the headrest.	Yes	12 (80.0%)	15 (100%)	0.25
11 - Practice macro and micro adjustments of the sliding base with joystick.	Yes	14 (93.3%)	15 (100%)	1.00
12 - Adjust microscope 90° to facial plane with illumination set at 45° angle (angle left for patient's right eye, and right for left eye).	Yes	7 (46.7%)	15 (100%)	0.008
13 - Perform outer structure evaluation.	Yes	14 (93.3%)	15 (100%)	1.00
14 - Perform anterior chamber evaluation.	Yes	5 (33.3%)	15 (100%)	0.002
15 - Look for cells and flare.	Yes	4 (26.7%)	12 (80.0%)	0.02
16 - Place a drop of tetracaine/proparacaine on a sterile fluorescein strip.	Yes	15 (100%)	15 (100%)	NA
17 - Place the fluorescein in the inferior fornix of the eye by pulling down on the lower lid and gently touching the bulbar conjunctiva with the fluorescein strip.	Yes	9 (60.0%)	15 (100%)	0.03
18 - Adjust cobalt blue filter on diaphragm wheel at maximum beam height and medium width slit setting for fluorescein evaluation.	Yes	14 (93.3%)	15 (100%)	1.00
19 - Focus the slit beam at 9:00 position on limbus. Move across the cornea to the 3:00 position by tilting joystick laterally.	Yes	12 (80.0%)	15 (100%)	0.25
20 - Pull instrument base toward you when finished and lock in position. Turn off.	Yes	4 (26.7%)	13 (86.7%)	0.004
		Time 0, median [IQR]	Time 2, median [IQR]	*P*-value from Wilcoxon signed rank test
Subtotal score		12.0 [10, 16]	19.0 [19, 20]	0.002

IQR, interquartile range.

independent slit-lamp exam and identify critical findings for common ocular complaints (80%), enhancing their learning more than traditional lectures and reading alone (86.7%). Of the asynchronous materials, the video demonstration was the most used (53% used it "a lot" or a "great deal"); the PowerPoint lecture and WEH Manual were the least used. At two months post-ED SLIT LAMP (Time 3), 73% and 67% of participants expressed extreme confidence in performing and teaching a resident how to perform a slit-lamp exam. Five t of 15 EPs reported teaching learners within the two-month

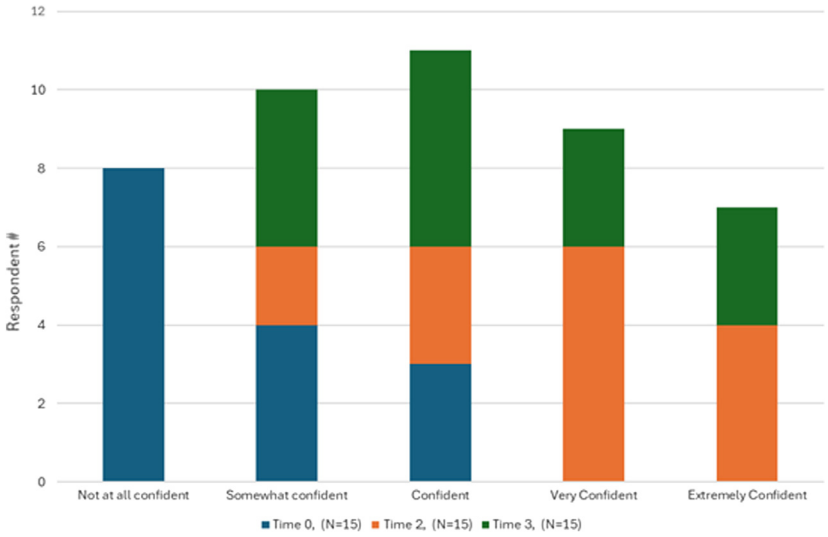

Figure 2. Learner confidence in performing the slit-lamp exam at Time 0 (pre-curricular), Time 2 (immediate post-SBML curriculum), and Time 3 (2-month post-SBML curriculum).

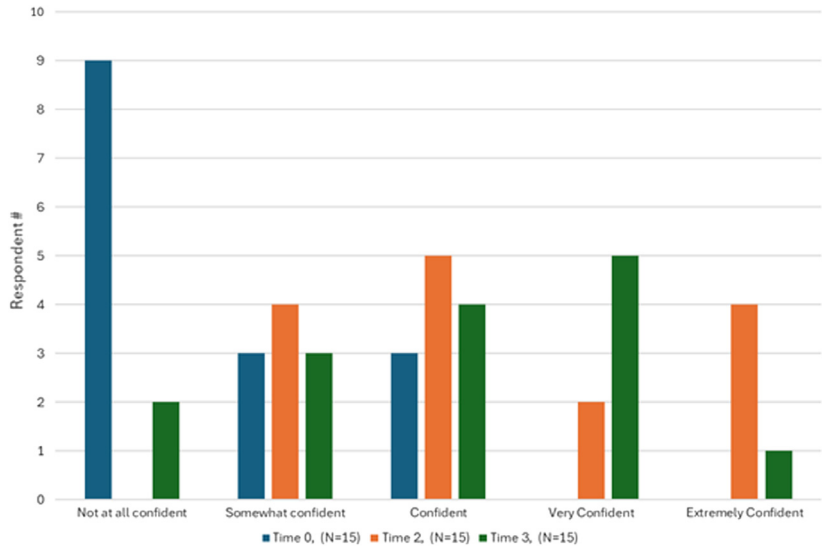

Figure 3. Learner confidence in teaching the slit-lamp exam at Time 0 (pre-curricular), Time 2 (immediate post-SBML curriculum), Time 3 (2-months post-SBML curriculum).

post-curricular period, ranging from 5–30 students per EP participant.

Table 4 summarizes the statistically significant findings from the survey responses based on the three timeframes. There was a statistically significant increase in self-reported confidence in 1) performing a comprehensive slit lamp exam and 2) teaching residents to perform this exam between Time 0 to Time 2 and Time 0 to Time 3 ($P < 0.001$). There was no difference in reliance on ophthalmology consultation to modify or reinforce a treatment plan for ocular complaints when comparing Time 0 to Time 3 ($P = 0.70$, $P = 0.814$). There was also no statistical difference in the number of patients with ocular complaints evaluated by the study participants at the TJUH ED and WEH ED throughout the study ($P = 0.14$, $P = 1.00$).

DISCUSSION

The ED SLIT LAMP curriculum allowed EPs to increase their use and confidence in performing slit-lamp exams in the ED. The impetus for the project arose from EPs' intrinsic motivation to provide better patient care. Our participant population consisted primarily of junior faculty who were initially uncomfortable performing or teaching slit-lamp exams and preferred using the Wood's lamp. Upon completing the curriculum, the EPs noted a significant increase in self-reported confidence in using slit-lamps

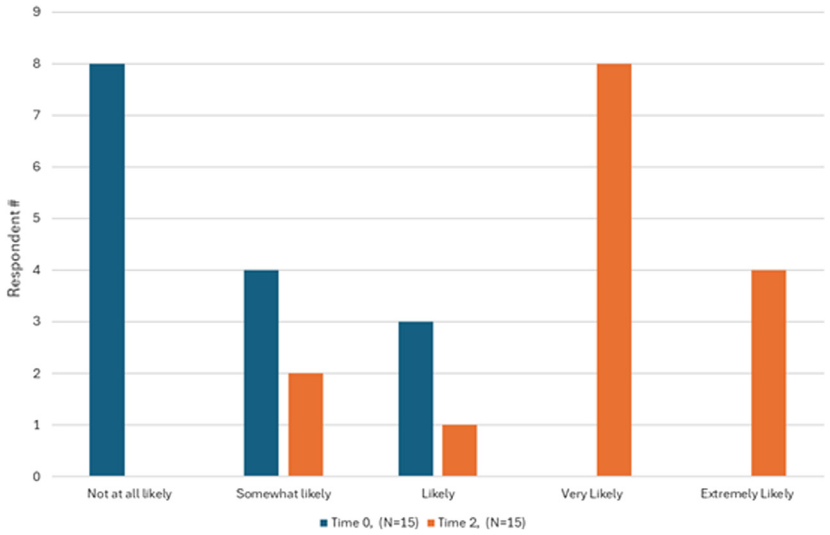

Figure 4. Learner likelihood in teaching the slit-lamp exam at Time 0 (pre-curriculuar) and Time 2 (immediate post-SBML curriculum).

and were teaching multiple junior learners during their study enrollment.

The improvement between the pre-and post-curricular procedural competency also demonstrates the importance of understanding the technical nuances of the slit-lamp exam and practicing critical device movement, such as careful patient positioning, adjusting of the chin straps, changing the microscope angulation, and adjusting varying slit-lamp beam lengths and widths for diagnosing a wide range of anterior ophthalmic pathologies. These skills are drastically different than those required to operate a Wood's lamp, which acts primarily as a magnifying glass with UV capabilities.

Our curriculum achieved three of the four Kirkpatrick goals. The majority of the participants (over 80%) reported positive reaction to the curriculum (the curriculum helped them perform a slit-lamp exam, evaluate for common pathologies, and offered more than traditional lectures) (Level 1); all of the participants demonstrated procedural mastery at Time 2 (Level 2); upwards of 50 learners received instructions from the study participants on how to use the slit lamp at Time 3 (Level 3). While the reliance on ophthalmology consultation did not reveal statistically significant changes, we posit that improved procedural acumen resulted in more targeted consultation questioning and improved rapport between the medical disciplines.

Since our participants were board-certified EPs with limited availabilities, the most valued component of the curriculum was the in-person RCDP session with the ophthalmologist (Time 2). This was reflected in almost every CIQ item, with specific mention of direct guidance in positioning the beam to look for cells and flare. The most surprising element to many participants was how many ocular diagnoses required the slit-lamp exam and that learning the procedure was not as complicated as they had initially anticipated. In contrast, many of the participants felt most distanced or removed from the curriculum in reviewing the asynchronous learning materials.

We were unsurprised to see the confidence levels in using Wood's lamp unchanged between the three different time frames. While the slit lamp offers a superior and in-depth evaluation of the anterior segment of the eye, we acknowledge that a comprehensive slit-lamp exam is time- and resource-consuming and may not affect the clinician's management if the suspected pathology involves larger lesions, foreign bodies, or specific reaction to fluorescein staining. The Wood's lamp remains an easier and more portable diagnostic tool for some ocular pathologies, and its use in the clinical arena is still acceptable in certain situations.

LIMITATIONS

This study was conducted at a single, large, tertiary academic center with an affiliated ophthalmology hospital and supported with internal grant funding. While the results were positive, multiple factors ciykd prevent this study from being replicated, especially at community sites without a close relationship with ophthalmology. One of the most significant challenges is scheduling in-person evaluations in the pre-curricular session, as well as the final in-person training and examination. We encountered significant logistical challenges in creating a schedule that was amenable to the ophthalmologists, EPs (with unpredictable shift schedules), and research investigators, as well as finding a consistent space in the WEH and WEH ED that had access to an attached-observer scope to ensure the participants were focusing on the correct anatomic structure during their procedural demonstration. This was further exacerbated when accounting for the "unlimited attempts" for RCDP. As this was our pilot study with advanced learners, we

Table 3. Statistical analysis of survey questions between the three different study timeframes.

Survey question	Time 0 median [IQR][a]	Time 2 median [IQR][b]	Time 3 median [IQR][c]	Bonferroni adjusted *P*-value from Wilcoxon signed rank test time 0 vs. time 2	Bonferroni adjusted *P*-value from Wilcoxon signed rank test time 0 vs. time 3
Slit lamp					
Based on your current practice patterns: how confident are you in: performing a comprehensive slit lamp exam for ocular complaints?	1 [1, 2]	4 [3, 4.5]	3 [2.5, 4]	<0.001	<0.001
Based on your current practice patterns, how confident are you in: teaching residents to perform a comprehensive slit lamp exam for ocular complaints	1 [1, 2]	3 [2.5, 4.5]	3 [2, 4]	<0.001	0.004
How often do you: perform an independent slit lamp exam for ocular complaints?	2 [1, 2.5]	n/a*	3 [3, 3]	n/a*	0.064
Wood's lamp					
Based on your current practice patterns, how confident are you in: performing a comprehensive Wood's lamp exam for ocular complaints?	4 [2, 4]	4 [4, 5]	4 [3, 5]	0.016	0.03
Based on your current practice patterns, how confident are you in: teaching residents to perform a comprehensive Wood's lamp exam (with access to a slit lamp) for ocular complaints?	4 [2, 4]	4 [4, 5]	4 [3, 5]	0.03	0.08
How often do you: use a wood lamp (with access to a slit lamp) for ocular complaints?	3 [3, 4]	n/a*	3 [3, 3]	n/a*	1.00
Ophthalmology consultation habits					
How confident are you in identifying common ocular pathology seen in your main work site (CC, MHD, Urgent Care)?	2 [2, 3]	n/a*	3 [3, 4]	n/a*	0.018
On average, how many eye pathologies do you see at the main work site?	10 [4, 15]	n/a*	5 [3, 12.5]	n/a*	0.14
On average, how many eye pathologies do you see at other facilities?	12 [0, 40]	n/a*	37.5 [13.5, 50]	n/a*	1.00
How often do you rely on ophthalmology consultation to: help modify your treatment plan for ocular complaints?	3 [3, 3]	n/a*	3 [2.5, 3]	n/a*	0.70
How often do you rely on ophthalmology consultation to: reinforce your treatment and plan for ocular complaints?	3 [2, 3]	n/a*	3 [2, 3]	n/a*	0.814
How often do you rely on ophthalmology consultation to: provide additional information and guidance to your treatment and plan for ocular complaints?	3 [3, 4]	n/a*	3 [3, 3.5]	n/a*	1.00

Confidence levels: 1 = Not at all confident, 5 = Extremely confident
Frequency levels: 1 = Never, 5 = Always
[a]Time 0 = pre-curricular evaluation.
[b]Time 2 = immediate post SBML exam. Frequency of slit lamp and Wood's lamp use were intentionally omitted for Time 2 due to the close proximity between Time 0 and Time 2, thus resulting in 'n/a' for some calculations.
[c]Time 3 = three months after SBML exam.
CC, Jefferson Hospital in Center City Philadelphia; *MHD*, Jefferson Methodist Hospital; *IQR*, interquartile range.

over-budgeted a two-hour template for each learner, which drastically limited the number of participants we could schedule for the final in-person exam.

Due to the longitudinal nature of this study and several in-person components, maintaining participant recruitment and engagement was also difficult. Of the 50 eligible board-certified TJUH EPs, only 15 EPs volunteered to participate. The primary deterrence, when discussed with non-participants, was time restraints and commuting into the city for in-person evaluations and examinations. We suggest implementing dedicated teaching days (ie, conference days or faculty meetings) for larger participant recruitment and subsequent follow-up and examination.

This study was funded by an internal grant that provided minor financial incentives for the participants and standardized patient volunteers. While our needs-based analysis revealed participants were more focused on promoting better patient care, many of the participants expressed appreciation for the staggered gift cards, which also incentivized them to complete each timeline-specific survey. All other investigators' efforts, in contrast, were in-kind and required dedicated non-academic and non-clinical time to enroll participants, record all the interactions, and provide unrestricted time availabilities for the final mastery assessment. This study was also unanimously supported by both departmental leaderships to promote a better collegial relationship and interdisciplinary education opportunity between organizations with the two principal investigators holding unique leadership positions, ophthalmology consulting director [CC] and EM clerkship director [XCZ]. We suspect that also positively affected our recruitment process and the success of this interdisciplinary training curriculum. As this study was conducted at an academic hospital in an urban setting, it has been suggested that academic centers likely overestimate EP comfort and confidence in the diagnosis and management of ophthalmic emergencies.[9] Furthermore, the proximity between both EDs may skew the data, as these EPs are likely exposed to fewer ophthalmic emergencies than hospitals without a nearby eye-focused ED.

Ultimately, the biggest limitation to this pilot study was the lack of in-person skill assessment at the 60-day follow-up due to limited staffing and scheduling challenges. In lieu of an objective competency score, we leveraged self-reported confidence at the 60-day mark as an approximate measurement of the skill retention. We recognize that learners are poor at gauging their own abilities, both over- and underestimating their skills based on a variety of factors. It is notable that 80% of our learners were initially "not confident" in completing a comprehensive slit-lamp exam prior to the SBML curriculum and scored an average checklist score of 60%. At Time 2, almost 87% of responders were "confident" in completing a comprehensive slit-lamp exam after receiving an average checklist score of 95%. Unfortunately, there is no association between learners' confidence and passing rate (score >18) at Time 0 (Pearson chi-square 3.46, $P = 0.17$) and Time 2 (Pearson chi-square 0.833, $P = 0.66$), respectively. While we are unable to predict how these learners would have performed on their slit-lamp exam test at day 60, we are encouraged to see the number of study participants who continued to teach slit-lamp exam for junior learners. We posit these participants will likely have improved sustained competence and decreased skill decay by actively teaching others. Future studies should be considered to add a final examination (procedure or multiple-choice question) to validate our results.

CONCLUSION

Emergency physicians are expected to diagnose and manage ocular complaints as part of their training and clinical practice. Our primary focus was to create a rigorous methodologic training curriculum (slit-lamp exam) for a specialty-focused skillset that could result in downstream teaching. This project highlighted a significant need for slit-lamp exam training within our institution that led to a successful transdisciplinary simulation-based mastery learning curriculum and improved our EPs' confidence in performing and teaching slit-lamp exams to future clinicians. Furthermore, this study demonstrates that adult learners, especially attending physician value direct interaction with clinical instructors when learning a new skillset and are intrinsically motivated to hone their skillset and teach it to future learners when they have achieved this mastery. We encourage other institutions to leverage SBML as a teaching modality for procedural-based training and advocate cross-discipline education initiatives. Future investigation could include creating a multicenter study to implement this curriculum at other academic institutions and potentially include it in EM residency training.

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Teaching the New Ways: Improving Resident Documentation for the New 2023 Coding Requirements

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BACKGROUND

In January 2023, significant changes to the structure of the Current Procedural Terminology CPT(R) evaluation and management (E/M) codes (here forward called the 2023 E/M changes) were implemented for emergency department (ED) encounters. These modifications aim to lessen administrative workload and accurately match coding with contemporary patient care practices.[1] They are anticipated to impact roughly 85% of the relative value units of ED care[2] and, thus, also have significant financial implications for EDs. Residents provide front-line care and documentation for millions of patients seen in United States EDs annually. The Model of Clinical Practice of Emergency Medicine[3] identifies financial principles, such as billing and coding, to be required core content for board certification. Furthermore, the Accreditation Council for Graduate Medical Education (ACGME) includes quality clinical documentation to be one of the milestones that determine advancement in residency training.[4] Interventions that alleviate documentation burden are also associated with improved physician well-being per the existing literature.[5] However, research suggests that most emergency medicine (EM) residents do not receive formal training in billing and coding and have knowledge gaps in this area.[6–8]

Historically, documentation of encounters in the ED focused on the number of elements within history of present illness (HPI), review of systems (ROS), physical exam (PE), and medical decision-making (MDM). These new coding guidelines shift the focus almost entirely to MDM. They emphasize documentation of differential diagnoses; independent interpretation of medical testing; justification of testing not pursued; social determinants of health; chronic diseases; histories; communication with consultants, ancillary staff, and primary care; and review of external records.

OBJECTIVES

We sought to improve resident understanding of and compliance with the 2023 E/M changes. Objectives included identification of the key elements required at each E/M level, charting and receiving feedback of sample encounters, and appreciation for the importance of accurate and high-quality documentation. We secondarily sought to investigate whether our intervention improved resident wellness specifically via benefits in confidence to perform accurate and expeditious documentation and completion of charting in a timely manner.

CURRICULAR DESIGN

Our curriculum was developed using Kern's six-step approach to curriculum design[9] as a part of the educational quality improvement process at a single EM residency program based at a single, large, tertiary-care, urban hospital with an approximate annual ED patient census of 110,000 from October 1, 2022–February 28, 2023. Prior to study initiation a needs assessment was performed. Key stakeholders in departmental billing and coding were identified and interviewed, and relevant literature was reviewed.[1–10] This included the hospital chief medical information officer, ED vice chair, and billing and coding leadership. The interviews revealed a shared opinion that often the documentation to reach the appropriate expected level of service (4 or 5) was lacking to support that level of billing and most of that documentation should be captured in the MDM portion of the note. Thus, the MDM portion of the note was targeted for the intervention.

Our educational methods primarily used in-person, flipped-classroom sessions. We decided to use a flipped-classroom approach for several reasons: 1) to allow residents to gain exposure to the new billing criteria prior to the in-person sessions; 2) as a mechanism to assess resident understanding and skills, both individually with homework responses as well as in a group setting; and 3) to use faculty's in-person time for oversight and feedback.[11] We also applied a spaced learning approach to maximize knowledge acquisition and retention.[12] The sessions were held on December 14, 21, and 28, 2022.

For pre-session homework each week, all residents were provided a sample patient HPI, ROS, and PE components. All learners were provided the same case, and cases were changed each week. Cases were formulated to include elements that could be expanded upon in the MDM, Residents were also provided with the "CPT Evaluation and Management (E/M) Code and Guideline Changes" document.[10] They were then asked to create an MDM section in accordance with the above document. Homework responses were reviewed by faculty, and feedback was given individually via email. Written feedback for residents was generated using a template based largely on the 2023 E/M guidelines changes.[10] An ideally documented sample MDM section was also supplied for reference (Supplement 1).[13]

During each 30-minute session, residents were divided into small groups of four and provided an example patient case, which included only the HPI, ROS, and PE components. Residents then collaboratively wrote an MDM section for the case. All groups were provided the same case, and cases were changed each week to focus on different aspects of the MDM section. Each small group of residents shared their response with the larger group and were provided peer feedback under the guidance of a faculty facilitator selected for their advanced knowledge in either education or operations. Facilitators were provided in advance with an example of an ideally documented MDM section, which residents were also provided with at the conclusion of the exercise.

IMPACT/EFFECTIVENESS

We employed a pre-post interventional study design using a convenience sample of residents, in which group assignment was based on the number of trainings each resident could attend due to scheduling factors outside the scope of this study. This study was determined to be exempt by the institutional review board of Maimonides Medical Center. Participation was voluntary and anonymous. We evaluated the impact of our brief educational intervention on subjective measures of EM resident knowledge, skills, and attitudes via survey and on objective measures of skills and behaviors by assessing aggregate chart data.

Surveys were developed through a group iterative process that included one author (ASC) with expertise in survey design methodology. RedCap,[14,15] hosted at [Maimonides Medical Center] was used to anonymously distribute both pre- and post-intervention surveys. Both surveys consisted of six Likert-scale questions, three regarding their reported use of documentation shortcuts, and three assessing attitudes about their own understanding of and predicted skill with the new E/M coding changes. Six additional multiple-choice questions assessed knowledge about documentation rules. A final question was for feedback and requested ideas for other E/M billing and coding education. The pre-intervention survey, distributed November 30, 2022, differed from the post-intervention survey of December 28, 2022, only in asking the self-reported number of sessions attended. (Supplement 2).

Resident skills were assessed using actual clinical documentation. Resident aggregate E/M levels were assessed across three months pre-intervention (October 1–December 31, 2022) and two months post-intervention (January 1–February 28, 2023). Due to variation in resident clinical schedules, we chose the above time periods to capture the greatest proportion of the ED encounters documented by residents. We used the Kirkpatrick model to evaluate our intervention's impact.[16] Surveys were used to assess resident subjective reactions, and objective knowledge by identification of billable elements in a provided sample MDM. We used actual clinical documentation to assess changes in behavior. Specifically, we assessed whether trainees had a statistically significant increase ($P < 0.05$) in the proportion of E/M level 5 charts (99285) and likewise a significant decrease in level 1, 2, 3, and 4 charts (99281, 99282, 99283, 99284).

We used descriptive statistics and comparison of means with the Mann-Whitney U test stratified by number of educational sessions attended to analyze significant differences in knowledge and attitudes before and after the intervention. For knowledge, these calculations were summarized with median and interquartile range (IQR) and compared across time periods using an exact Wilcoxon signed-rank test. A Bonferroni correction for the significance of the intervention changes the alpha to 0.01667. For each chart level (99281–99285), we created logistic regression models using generalized estimating equations for individual repeated measures to account for personal variability. The number of attended flipped-classroom sessions was treated as the independent variable. Zero trainings were considered to be the pre-period for analysis. All analyses considered alpha ≤ 0.05 to be statistically significant and were conducted using SPSS v 28.0[15] (SPSS Statistics, IBM Corp, Armonk, NY).

Forty-six of the 54 EM residents (85%) eligible for the study completed both pre- and post-intervention surveys. All 54 residents participated in at least one survey. Due to clinical schedules, some residents were not present at one or more of the three offered sessions. The first live session was attended

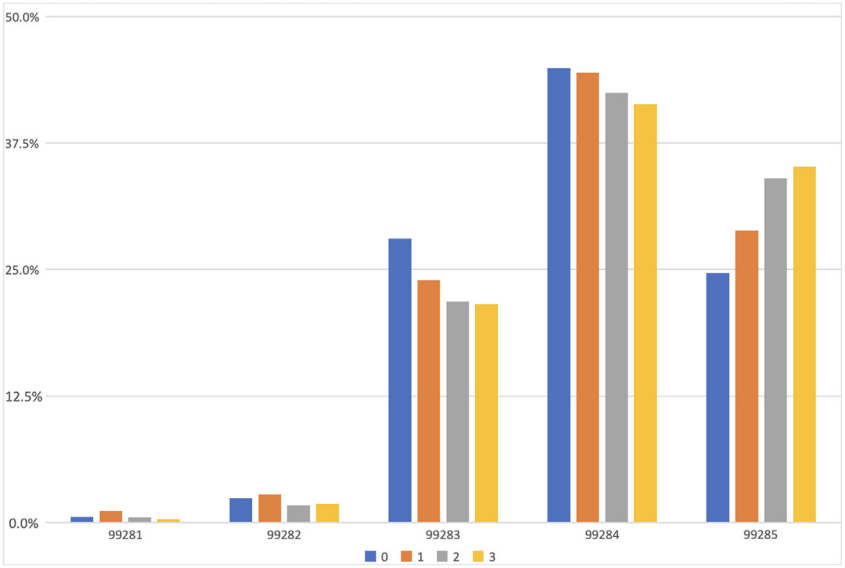

Figure. Proportion of each Current Procedural Terminology evaluation and management level by number of educational sessions attended.

by 33 (61%) residents, the second by 38 (70%), and the third by 40 (74%). Six (11%) residents attended one session, 15 (28%) attended two sessions, and 25 (46%) attended three sessions. Eight (15%) did not attend any sessions.

Residents demonstrated a significant improvement in knowledge regarding which elements are the key to the MDM within the 2023 E/M changes [6 (5–6.5) to 8 (7.5–8) $P < 0.001$], and by correctly identifying the number and complexity of problems, complexity of data, risk level, and the overall complexity of a sample encounter. There was no statistically significant improvement in identification of the important coding elements (4 [3–5] to 5 [3.5–5], $P = 0.38$). Residents also endorsed greater confidence in their ability to describe (2 [1–3] to 4 [3–4], $P < 0.005$), accurately document (3 [2–3] to 4 [3–4], $P < 0.005$), and bill (2 [2–3] to 3 [2–3] $P < 0.005$). There were no significant changes in their opinion of their ability to complete their charts in a timely manner ($P < 0.19$, CI 0.165–0.215) in the decision to use dictation software ($P = 1$), shortcuts ($P = 1$), or custom prepared text phrases ($P = 1$) following the intervention. Residents participating in any number of flipped-classroom sessions showed significant changes in their skills, including an increase in E/M Level 5 coded charts, and a significant decrease in Level 1, 2, and 3 coded charts ($P < 0.005$). The increase in Level 5 charts and decrease in Level 3 charts were significant after just one session (Figure). No significant change was observed in Level 4 charts.

To the best of our knowledge, this is the first study to date to describe the impact of an educational intervention on EM resident documentation knowledge, skills, and attitudes within the framework of the 2023 E/M changes. Naturally, our experience and results at our single EM residency program based at a large, urban, tertiary-care hospital may not be generalizable. This intervention data is single center and preliminary, and the intervention should undergo repetition and comparison before firm conclusions can be drawn.

We chose to collect data during a time range tied to the same illness season to keep the case acuity mix and attending/resident staffing comparable. We otherwise could have compared to the same months of the previous year for pre-intervention data, to best match the illness season, or alternatively, post-intervention data could have been drawn instead from the following year (2024) to help mitigate recency bias in the intervention group. That being said, the major differences in resident and attending staffing between times a year apart could also have confounded results.

We considered faculty supplemental documentation and its effect on documentation outcomes during our study design and took a pragmatic approach. For the duration of this study the attending population was stable, no significant changes to attending education were performed during this period, and attending staffing remained at baseline with no changes to ratios, shift durations, or standard distributions of encounters throughout the ED care areas. To further address this concern we attempted analysis of the attending distribution between these various groups. No attending had a greater than 1.4% change in their billing from pre- to post-intervention, and their small contributions to the overall billing for each intervention group was, therefore, unlikely to have biased the large differences seen between groups. However, the differences in distribution of attending shifts between the groups varied statistically significantly, and bias

cannot be assessed without patient-level billing records. This could be considered in future studies.

Our program may have implications regarding wellness as well. Residency training must prepare emergency physicians for all aspects of their eventual professional expectations. Residents receiving education expressed greater confidence in their ability to describe, accurately document, and bill for care provided. Business literature frequently notes how a lack of clear expectations increases work stress and harms employee wellness and productivity.[18] However, whether this association applies to emergency physicians deserves further study.

CONCLUSION

Overall, we observed significant improvements in resident knowledge, attitudes, skills, and behaviors regarding clinical documentation. We hope to apply these successes and lessons learned to the formation of enduring education materials at our own institution for documentation improvement for both residents and attendings.

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Telesimulation Use in Emergency Medicine Residency Programs: National Survey of Residency Simulation Leaders

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Introduction: Coronavirus 2019 (COVID-19) accelerated the need for virtual learning including telesimulation. Many emergency medicine (EM) programs halted in-person simulation and trialed telesimulation, but specifics on its utilization and plans for future use are unknown. Telesimulation has been defined as "a process by which telecommunication and simulation resources are utilized to provide education, training, and/or assessment to learners at an off-site location." Our objective in this study was to describe the patterns of telesimulation usage in EM residency programs during COVID-19-induced learning restrictions as well as its anticipated future utility.

Methods: We identified EM simulation leaders via the EMRA Match website, institutional websites, or personal contact with residency coordinators and directors, and invited them to participate by email. Participants completed a confidential, web-based survey consisting of multiple-choice items and one free-response question, developed by our study team with consideration of survey research best practices and Messick's validity framework. We collected data between January–February 2022. We calculated descriptive statistics for multiple-choice items and examined the free-response answers for common themes.

Results: We obtained contact information for simulation leaders at 139 EM residency programs. Survey response rate was 65% (91/139). During in-person restrictions, 62% (56/91) of programs used telesimulation. Assuming all restrictions lifted, 38% (34/90) of respondents planned to continue to use telesimulation, compared to 9% (8/91) using telesimulation before COVID-19. Most respondents planned to use telesimulation for medical knowledge (26/34, 76%) and communication/teamwork-focused cases (23/34, 68%). In response to the free-response question regarding experience with and plans for use, we identified three major themes: 1) telesimulation is a valuable alternative to in-person learning; 2) telesimulation is an option for learners unable to participate in person; and 3) telesimulation is challenging for procedural education.

Conclusion: Despite the relatively limited use of telesimulation in EM residencies prior to COVID-19, an increased number of programs have plans to continue incorporating telesimulation into their curricula. This plan for continued use opens opportunities for further innovation and scholarship within simulation education. [West J Emerg Med. 2025;26(1.2)42–47.]

INTRODUCTION

Restrictions imposed on in-person education during the coronavirus 2019 (COVID-19) pandemic accelerated the need for virtual learning, including telesimulation.[1,2] Telesimulation has been defined as "a process by which telecommunication and simulation resources are utilized to provide education, training, and/or assessment to learners at an off-site location."[3] Initial applications were in lower resource settings such as developing countries where learners did not have access to simulation centers or instructors.[4,5] Within telesimulation, different modalities have been described that vary in fidelity as well as location of the learners and instructors relative to each other and the simulation center.[6–8]

Several published articles since early 2020 have described different institutions' approaches to telesimulation since the pandemic.[1–2,9–13] Common themes include the need to modify learning objectives to virtual environments and to select the appropriate modality of telesimulation based on institutional needs and resources.[9–12] Different modalities of telesimulation have been described, including the following: 1) learners virtually observing and debriefing a live simulation[7]; 2) learners present with a manikin while instructors facilitate from a separate location[6]; 3) instructors present with a manikin while learners remotely participate[7]; and 4) completely remote option where learners and instructors both participate remotely from separate locations.[10,11]

Limited data comparing telesimulation vs traditional simulation suggests that learner satisfaction with telesimulation or hybrid virtual and in-person simulation is similar, although this was not found in all studies.[7,13,14] A scoping review from 2021 highlighted the mixed data on student perception of telesimulation, with some of the included studies indicating remote facilitation of simulation being perceived as equally or more effective than live facilitation, while others found remote facilitation to be inferior.[14] Facilitator perception of telesimulation has not been well studied. Limited learning outcome data has suggested similar improvements between in-person simulation and telesimulation.[8,14]

Our objective in this study was to describe the patterns of telesimulation usage in emergency medicine (EM) residency programs during COVID-19-induced, in-person learning restrictions as well as its anticipated utility moving forward. This information is crucial to understanding the value of telesimulation and its utility in medical education.

Population Health Research Capsule

What do we already know about this issue?
COVID-19 accelerated the need for virtual learning including telesimulation.

What was the research question?
To what extend was telesimulation used by EM residencies during COVID-19, and what is its anticipated utility moving forward?

What was the major finding of the study?
Only 9% (8/91) of programs used telesimulation before COVID-19. During COVID restrictions, 62% (56/91) of programs used it, while after limitations were lifted, 38% (34/90) planned to continue telesimulation.

How does this improve population health?
As an adjunct to traditional in-person simulation curriculum, telesimulation is a viable option to improve medical knowledge and communication-based competencies.

METHODS

Study Design, Setting, and Population

We conducted a cross-sectional survey study of faculty in charge of simulation for EM residency programs in the United States. We collected data from January–February 2022. After identifying EM residency programs and their websites from the EMRA Match database,[15] we searched each website for contact information for the director of simulation education. If there was no director designated, we emailed each residency's program coordinator and/or director asking for contact information for the faculty in charge of residency simulation. Each program was allowed only one designated participant. This study was given exempt status by the University of California, Los Angeles Institutional Review Board (IRB#21-001336) and the Johns Hopkins University Homewood IRB (HIRB00013694).

Survey Development and Dissemination

Given the lack of any previously created survey applicable to this construct, the primary author (MB) developed a web-based survey tool with consideration of survey research best practices and Messick's validity framework.[16–19] For content validity evidence, we first performed a literature review, and the author group of expert simulation educators and medical education researchers reviewed the survey for clarity and relevance to the construct. We defined telesimulation as including any simulation activity where "telecommunication and simulation resources are utilized to provide education, training, and/or assessment to learners at an off-site location."[3] We piloted the survey with a group of simulation educators who were not included in the target sample to gather response process validity evidence. After piloting, we revised the survey for clarity. The final survey included multiple-choice items and one free-text response item (Appendix 1).

We invited participants by email and sent two targeted, follow-up invitations to non-responders at bi-weekly intervals. We administered the survey via Qualtrics (Qualtrics, LLC, Provo, UT). No individual identifying information was collected. To maximize response rate and minimize guessing, we did not require participants to complete all survey items. Participants were not compensated for participating in the study.

Data Analysis

We calculated and reported descriptive statistics for items with discrete answers. We conducted calculations using Qualtrics and Microsoft Excel for Mac (Microsoft Corp, Redmond, WA). We examined the answers to the free-text responses to identify common themes that would broaden the reader's understanding of the data. Successive wave analysis was performed to assess the extent of possible nonresponse bias.[20] We examined whether use of telesimulation during the pandemic, planned future use of telesimulation after in-person restrictions, and respondent program format (postgraduate years [PGY] 1–3 vs 1–4) differed by wave. Bivariate chi-square tests for each variable of interest by wave were performed using Microsoft Excel for Mac, and *P*-values less than 0.05 were considered statistically significant. We used the consensus-based checklist for reporting of survey studies (CROSS) as reporting guidelines (Appendix 2).[23]

RESULTS

Of 139 simulation leaders we identified, 91 (65%) completed the survey with 87 (63%) completing all items. We report demographic data for survey respondents in Table 1, while respondents' experience and perceptions of telesimulation are shown in Table 2. Prior to the COVID-19 pandemic, 9% (8/91) of survey respondents were using telesimulation in their curricula. There was a wide variety of prior experiences with telesimulation, with the most common being that they had heard of telesimulation but never been involved (44%). Ninety-two percent (84/91) of respondents reported that their institution prohibited in-person learning activities at some point during the COVID-19 pandemic. During in-person learning restrictions, 62% (56/91) used telesimulation in some form.

When survey respondents were asked about what format(s) of telesimulation were used, 11% (10/90) stated that they only used a completely virtual oral-boards style format, while the rest of those who used telesimulation reported using a hybrid or virtual format involving a patient monitor and/or manikin. The largest percentage of survey respondents felt that medical knowledge and communication/teamwork-focused cases were best suited for telesimulation (72% and 47% respectively), while most felt that procedure training was not well suited for telesimulation (62%). Thirty-eight percent (34/90) of respondents stated they planned to use telesimulation in some form in their curriculum moving forward, mostly for medical knowledge and communication/teamwork-focused cases (76% and 68%, respectively).

Table 1. Survey respondent demographics.

	n (%)
Format of respondent's current residency program	
PGY 1–3	62/89 (70%)
PGY 1–4	27/89 (30%)
Size of respondent's current residency program (total number of residents in all years)	
≤20 residents	11/90 (12%)
21–40 residents	38/90 (43%)
41–60 residents	31/90 (34%)
≥60 residents	10/90 (11%)
Respondent's current residency program primary institution setting	
University-based	58/90 (64%)
Community-based	28/90 (31%)
County-based	13/90 (14%)
Prior simulation training of survey respondent	
Fellowship training in simulation	31/90 (34%)
Non-fellowship training in simulation	48/90 (53%)
No formal training in simulation	17/90 (19%)
Respondent years since residency graduation	
≤5	22/90 (24%)
6–10	33/90 (37%)
11–15	16/90 (18%)
16–20	8/90 (9%)
≥21	11/90 (12%)

PGY, postgraduate year.

We received 14 free-text responses, and identified three major themes, described below with exemplar quotes.

1. Telesimulation is a valuable alternative to in-person learning:
   "It has been the 'better than nothing' option but accepted by learners when other options are not feasible."
   "It has exceeded expectations in how helpful it has been."
2. Telesimulation is an option for learners unable to participate in person:
   "We found that it's a great option for residents with families or who have other extenuating circum-stances why they can't participate in person, ie, breastfeeding moms, new parents, elder care, etc. Many of our residents who are between nights or between mid-shifts will log on and participate."
3. Telesimulation is challenging for procedural education:
   "Difficult to learn muscle memory for high acuity, low occurrence skills."

Table 2. Key survey results.

	n (%)
EM residency program use of telesimulation	
Prior to COVID-19 pandemic	8/91 (9%)
During in-person learning restrictions	56/91 (62%)
Planned use after in-person restrictions lifted	34/90 (38%)
During any point in the COVID-19 pandemic, did your institution prohibit in-person learning activities?	
Yes	84/91 (92%)
No	7/91 (8%)
Experience with telesimulation prior to COVID-19	
Had never heard of telesimulation	17/91 (19%)
Heard of telesimulation but never involved	40/91 (44%)
Attended a presentation	20/91 (22%)
Participated as an instructor	19/91 (21%)
Participated as a learner	6/91 (7%)
Conducted a research project	5/91 (5%)
Read a paper about telesimulation	16/91 (18%)
Formats of telesimulation used during COVID-19 restrictions	
Completely virtual; utilizing real-time patient monitor and/or manikin	21/90 (23%)
Completely virtual; oral boards style cases	31/90 (35%)
Hybrid; instructor, learners and/or sim tech in sim center while others remote	31/90 (35%)
What simulation activities were best suited for telesimulation?	
Medical knowledge focused cases	65/90 (72%)
Communication/teamwork focused cases	42/90 (47%)
Procedure focused cases	5/90 (6%)
Dedicated procedure training	2/90 (2%)
Procedure training on homemade models	10/90 (11%)
What simulation activities were not well suited for telesimulation?	
Medical knowledge focused cases	0/87 (0%)
Communication/teamwork focused cases	18/87 (21%)
Procedure focused cases	52/87 (60%)
Dedicated procedure training	54/87 (62%)
Procedure training on homemade models	23/87 (26%)
Percent of future simulation curriculum involving telesimulation	
0% of the curriculum	56/90 (62%)
1–25% of the curriculum	30/90 (33%)
26–50% of the curriculum	3/90 (3%)
51–75% of the curriculum	1/90 (1%)
76–100% of the curriculum	0/90 (0%)
Types of future simulation activities for those who plan to continue using telesimulation	
Medical knowledge-focused cases	26/34 (76%)
Communication/teamwork-focused cases	23/34 (68%)
Procedure focused cases	7/34 (21%)
Dedicated procedural training	5/34 (15%)
Procedure training on homemade models	5/34 (15%)

EM, emergency medicine.

> "Procedural training was the most difficult to simulate via telesim."

For the wave analysis, the study included 91 respondents, including 42 in wave 1 (46%), 21 in wave 2 (23%), and 28 in wave 3 (31%). Results of the examined survey questions did not statistically differ by wave with all P-values > 0.05. (See Supplemental Table.)

DISCUSSION

Despite relatively low use of telesimulation within EM programs prior to the COVID-19 pandemic, we found that many EM residency programs (62%) quickly adapted to in-person learning restrictions by using telesimulation. While not all programs that trialed telesimulation plan to continue its use, 38% of respondent programs do plan to continue to use telesimulation, compared to 9% of programs using telesimulation prior to COVID-19. This represents a large increase in the overall usage of telesimulation within EM residencies. Our study also sheds light on how telesimulation can benefit EM programs. Being able to increase learner participation to include residents with family obligations or between night shifts could allow for increased return on investment for simulation resources and faculty time. Most respondents who plan to continue to use telesimulation reported that they will use it as a small percentage of their overall simulation curriculum, which highlights that telesimulation is not replacing in-person simulation but augmenting the traditional curriculum. This could be in a hybrid format that allows for increased participation, or as part of separate telesimulation days that could reduce the travel burdens on learners and instructors.

There was large variation in how programs conducted telesimulation during in-person restrictions. This is in line with prior literature and likely reflects individual program needs, preferences, and available resources.[1,2,8–11,13,22] Most described telesimulation as best suited for medical knowledge and communication/teamwork-focused cases, rather than for procedure teaching. This is interesting given that early descriptions of telesimulation in the literature mostly

involved procedural teaching.[5,6] One possible explanation for this discrepancy is that those early studies involved duplicate simulators at remote locations, an expense that is likely not practical, or necessary, for a residency program given the ability to host procedure training as part of the in-person curriculum. While it is apparent that there are increased plans for the use of telesimulation compared to the pre-pandemic era, not all residency programs who used telesimulation during times of in-person restrictions are planning to continue to do so. The reasons for this are unknown but may relate to telesimulation resource availability or limited outcome data on its utility.

Based on our results, we believe that telesimulation can continue to be a valuable addition to the traditional in-person simulation curriculum, particularly in allowing for increased participation of learners and instructors, reducing resource costs such as simulation center and staff time, and allowing for a viable option to practice medical knowledge and communication-based competencies. Now that telesimulation has been established as an instructional strategy that will continue to be part of many EM residency curricula, it opens opportunities for future innovation and scholarship within simulation-based medical education. Additional investigation could compare different modalities of telesimulation on objective learning outcomes.[23] It would also be interesting to explore the role of virtual and augmented reality within telesimulation.[24,25]

LIMITATIONS

Despite multiple attempts, we were not able to obtain contact information for a simulation leader from all EM programs. However, the breakdown of PGY 1–3 vs PGY 1–4 programs of survey respondents (70% PGY 1–3 vs 30% PGY 1–4), approximating the actual distribution of the EM residency programs (81% PGY 1–3 vs 19% PGY1–4), suggests that the sample closely resembles that of the population.[8] Given our response rate of 65%, it is possible non-response bias affected our results, with participants with less interest or familiarity with telesimulation being less likely to respond. However, the results of our successive wave analysis failed to detect non-response bias for the selected survey questions.

There may be other influences affecting a program's use of telesimulation that we were not able to capture, and in this survey study we examined only the opinions of faculty and not those of resident learners. Additionally, the literature-based definition of telesimulation we used may be overly broad and encompass more than what typical educators might consider telesimulation. Finally, we acknowledge that the survey was administered in 2022 with in-person learning restrictions just starting to be lifted, and how people are using telesimulation now may be changing. Future work could examine this evolving use of telesimulation within EM residency programs.

CONCLUSION

This study describes past and planned future use of telesimulation within EM residency programs. A large proportion of EM residencies trialed telesimulation during COVID-19-induced restrictions. Despite relatively low use of telesimulation prior to the pandemic, more EM programs plan to incorporate telesimulation moving forward as a limited portion of their overall simulation curriculum. Opportunities for further innovation and scholarship within this area of simulation education will be possible given this planned continued use.

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Substantial Variation Exists in Clinical Exposure to Chief Complaints Among Residents Within an Emergency Medicine Training Program

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Introduction: While many aspects of emergency medicine (EM) residency training are standardized among residents within a single residency program, there is no standard for the distribution of chief complaints (CC) that residents should see over the course of residency. This could result in substantial variability in each resident's clinical exposure. Our objective in this study was to explore EM residents' clinical exposure to CCs to determine whether substantial variation exists. If such variation exists, this could suggest the need for curricular reform to address gaps in resident clinical exposure during training.

Methods: This was a retrospective observational study of EM residents who graduated in the years 2016–2021 at a single, university-affiliated emergency department (ED) in the midwestern United States. All patient encounters where a CC was logged were included and categorized into 1 of 20 clinical domains based on the 2016 American Board of Emergency Medicine Model of Clinical Practice. We calculated descriptive statistics for the top 10 most encountered domains for comparison among residents.

Results: We included a total of 228,916 patient encounters from 69 residents in the analysis. Residents were involved in an average of 3,323 distinct patient encounters during the study period. The overall interquartile range for patient encounters was 523. The three CC domains with the broadest interquartile variation were abdominal and gastrointestinal disorders (116), musculoskeletal disorders (nontraumatic) (93), and traumatic disorders (86).

Conclusion: Within a single, three-year academic EM program, substantial variation existed among residents with regard to the variety of patient CCs seen during their residency training. [West J Emerg Med. 2025;26(1.2)48–53.]

INTRODUCTION

Medical residency training allows physicians to gain the cognitive and procedural skills necessary to practice independently. Based on experiential learning theory, patient encounters form the foundation upon which physicians in training begin to master the practice of medicine.[1] Additionally, the development of "illness scripts," or mental models for the classification of patient presentations, is crucial to the development of clinical skills and reasoning during residency training.[2] These models are developed over time by multiple exposures to presentations of similar disease states.[3,4] Emergency medicine (EM) trainees must be exposed to a variety of patient chief complaints (CC) throughout the course of residency to develop these scripts and become ready to begin independent practice.

Educators within EM have worked to define many aspects of EM residency training, including optimum number of shifts, on-shift educational goals/practices, and didactic content.[5] Despite this, the clinical experience of an individual resident may be highly variable and may be partially driven by self-selection of patients by the resident. Studies in pediatric EM suggest that there is significant variation in the overall number of patients and range in acuity among individual residents.[6,7] However, there is little adult EM literature that explores the variation in clinical experience seen by residents within a modern EM program. The literature that does exist in adult EM suggests there is substantial variation in clinical exposures among residents.[8] A study from 2006 found that the number of cases seen overall correlated with improved performance on a standardized test designed to assess clinical competence. However, the effect plateaued at around 200 cases.[9] Prior work by our group has shown that case volume in an individual domain did not correspond to performance within that domain on corresponding questions on the in-training exam.[10]

These studies suggest that individuals within a single training program may be gaining variable experience with certain types of patient presentations and lacking exposure (and therefore opportunities to develop mastery) to other complaints and pathology. However, this variability in clinical exposure during training has not been shown in adult EM for over three decades.[8] Since then, the number of annual visits to the ED as well as the complexity of medical care provided have substantially increased.[11,12] We, therefore, hypothesized that substantial differences in clinical exposure still exist among residents at the time of graduation. Understanding these differences is of critical importance for residency programs as considerable variation could push some residents below a threshold to develop robust illness scripts suitable for independent practice.

Population Health Research Capsule

What do we already know about this issue?
Studies from 30 years ago reported variation in the distribution of chief complaints seen by emergency medicine residents during training.

What was the research question?
We hypothesized that substantial differences in clinical exposure still exist among residents at the time of graduation.

What was the major finding of the study?
The three chief complaint domains with the most variability between individual resident experience, as measured by the greatest 25–75 interquartile ranges were abdominal and gastrointestinal disorders (median 594 patients per resident, IQR 116), nontraumatic musculoskeletal disorders (median 314, IQR 92), and traumatic disorders (median 525, IQR 86).

How does this improve population health?
Understanding these differences is important, as substantial variation could mean that some residents do not develop robust illness scripts suitable for independent practice.

METHODS

Study Design and Setting

We conducted this retrospective, observational study at a three-year EM residency program situated within an urban, academic emergency department (ED) in the Midwest. The ED for the primary clinical site has a total of 54 beds and sees an annual volume of approximately 60,000 patient visits. During the study period, the residency had 12 first postgraduate year one (PGY-1) positions available each year. The study ED divides its beds into two adult clinical areas and a pediatric clinical area. All three areas are physically connected on a single floor of the hospital. Residents from all three years are assigned to nine-hour shifts in each clinical area. Each shift includes 1–2 junior (PGY-1) residents, 1–2 senior (PGY-2 or PGY-3) residents, and one attending physician. Any resident can assign themselves to patients of any severity regardless of seniority. In Fall 2020, the study ED shifted from a "pod" model in which the two adult clinical areas would assign themselves predominately to patients in their clinical area to a "free-for-all" model in which either adult team could assign themselves to any adult patient regardless of the clinical area they were roomed in. During the study, physician assistants were employed in the ED and would occasionally take the place of a resident on shift (particularly during weekly resident didactics).

Data Acquisition

Residents were eligible for inclusion if they had completed residency within three consecutive years and graduated in the years 2016–2021 (therefore, the study period was from June 2013–June 2021). The electronic health record (EHR) was used to create a database of patient encounters; all encounters where eligible EM residents were the first resident assigned to the patient were analyzed. We used deidentified patient encounter data, listed by first CC. The CC was used to identify the nature of the patient encounter as this data was available at the time of patient presentation, often dictates the patient's ED workup, and would not have been affected by information discovered during the later stages of a

patient's hospital course. This approach is consistent with prior literature.[9,13] To maintain anonymity, only the senior author, a member of the residency leadership team, had access to each resident's individualized study identification number.

We excluded from analysis encounters where no CC was listed or no resident was assigned. In cases where multiple residents were assigned to a single encounter (e.g., a patient had been signed out to a different resident), we analyzed this encounter only for the initial resident assigned. This was done as they are typically the most involved in the cognitive workload of determining the patient's initial diagnostic and treatment plan. The CC for each encounter was selected and entered into the EHR by the primary nurse who cared for the patient in the ED initially. At our institution, this is nearly always selected from a list of common CCs, although it can be entered as free text. Encounters in which multiple CCs were listed were only coded into a single domain based on the first listed CC.

Data Analysis

A list of common CCs in EM has been categorized into a set of 20 content domains via a consensus process by two EM attendings using the 2016 American Board of Emergency Medicine (ABEM) Model of Clinical Practice as a framework.[14] For CCs identified in our data that were not already categorized by a previously described method,[13] we repeated the same categorization process in which each CC was assigned to a single domain by two board-certified EM attending physicians at our institution. Disagreements between the two reviewers were adjudicated by a third board-certified emergency physician. If a symptom was entered as the CC, such as "fever" (which could correspond to one of multiple domains), it was preferentially categorized into a domain based on what the coding physicians felt was the most likely to dictate the ED workup, rather than the "signs, symptoms, and presentations" domain. We used Excel (Microsoft Corp, Redmond, WA) to calculate descriptive statistics and create plots and tables. The top 10 most encountered domains overall were analyzed. We excluded less common domains given the low number of total encounters in each area, which would have been more vulnerable to random fluctuations in when these patients present to the ED.

This project was deemed exempt quality improvement by the University of Wisconsin Health Sciences Institutional Review Board.

RESULTS

A total of 315,614 encounters were initially identified from the EHR. Of these encounters 198 were excluded as no CC was listed. After excluding residents whose clinical experience was outside the study period and those who had left the training program prior to graduation or had a prolonged leave of absence, a total of 228,916 patient encounters from 69 residents were included in the analysis. Each resident was assigned to an average of 3,323 distinct patient encounters Assessment of the top 10 most common clinical exposure domains showed wide ranges in the case numbers of individual residents. The Table lists the mean, minimum, maximum, interquartile range (IQR) and 25th and 75th percentile for the 10 most common content domains. The Figure shows the range of exposure to the 10 most common domains in box-and-whisker format.

DISCUSSION

Our data suggests that residents within a single training program have substantial variation in their clinical experiences as measured by the variation in ABEM content

Table. Mean, 25th–75th percentile ranges, interquartile range, and minimum/maximum encounters for the 10 most encountered domains per resident.

	Mean	Median	25th, 75th percentile	IQR	Minimum, maximum
Total encounters	3323		3086, 3609	523	2595, 4053
Abdominal and gastrointestinal disorders	583	594	528, 644	116	416, 721
Traumatic disorders	529	525	484, 570	86	370, 725
Cardiovascular disorders	327	330	302, 356	54	233, 429
Nervous system disorders	319	319	301, 340	39	226, 402
Musculoskeletal disorders (non-traumatic)	314	314	269, 361	92	179, 460
Thoracic-respiratory disorders	280	281	246, 313	67	178, 383
Systemic infectious disorders	165	169	149, 179	30	115, 219
Head, ear, eye, nose, and throat disorders	150	151	136, 165	29	96, 196
Signs, symptoms, and presentations	129	130	120, 142	22	88, 170
Psycho-behavioral disorders	126	128	106, 139	34	67, 211

IQR, interquartile range.

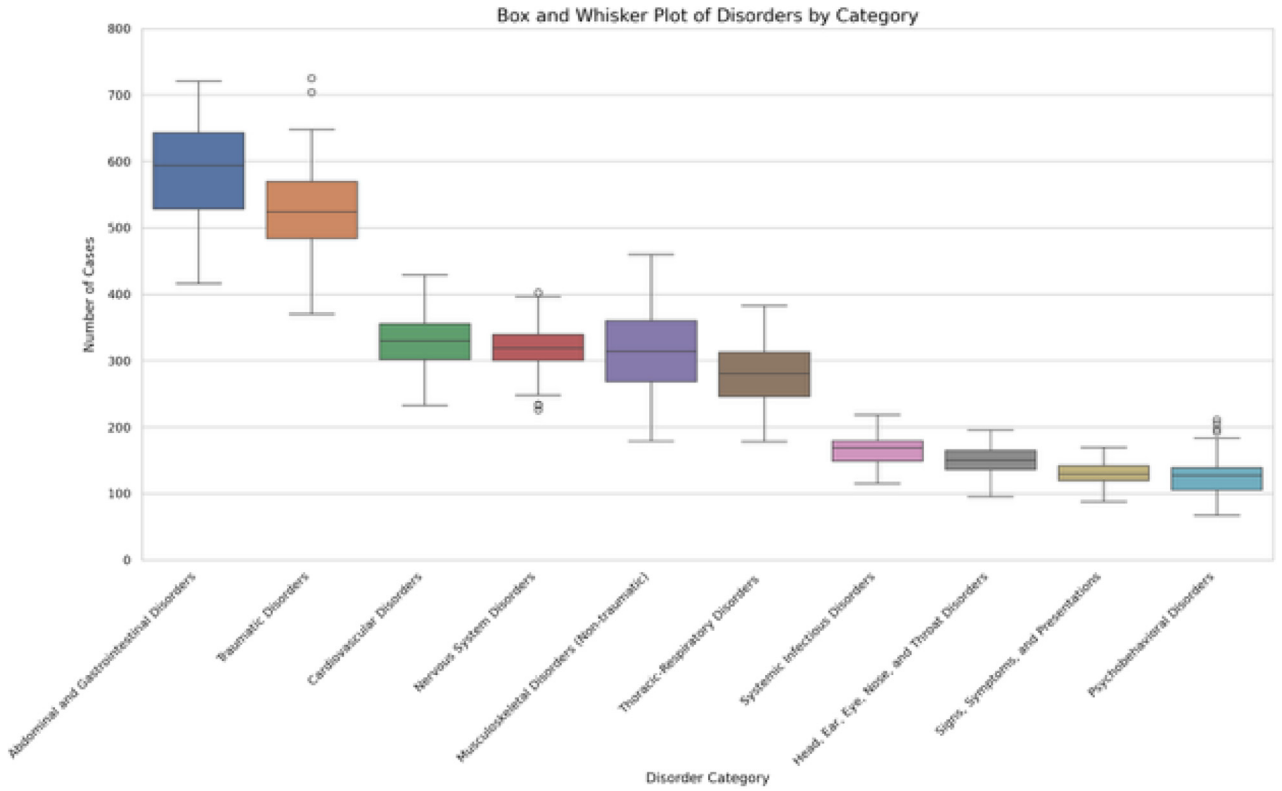

Figure. Top 10 most common clinical exposure domains seen by graduation per resident. Boxes illustrate the 25th–75th percentile of number of clinical exposures by residents in each domain, with whiskers representing the minima, maxima, and outliers.

domains seen by individual residents. This is similar to what was described by Langdorf et al. in 1990, despite the previous study being performed over three decades ago and the substantial subsequent differences in the utilization of the ED.[8] We found wide interquartile ranges between the maximum and minimum number of encounters among residents, suggesting that some residents saw substantially more patients within particular domains than others.

The magnitude of the educational significance of the exposure variability of residents is unclear. It is possible that a resident who sees twice as many musculoskeletal chief complaints as another resident by graduation is significantly more competent in that domain. Alternatively, it is also possible that they have both attained the minimal level of exposure to competently manage musculoskeletal complaints independently. The effects of clinical exposure on clinical competence, including the minimal number of encounters required to demonstrate competency in a particular domain, is an open question and an avenue for further research. However, the formation of illness scripts is continually modified by subsequent patient encounters.[3,4] Therefore, the identification of high degrees of variation among residents may prompt program leadership to institute changes in the curriculum or supplement clinical exposure with individualized learning plans. This is likely more important for domains that are encountered less frequently overall, such as psycho-behavioral disorders, where larger relative differences in exposure could result in greater deficits in illness script formation.

In addition to prompting changes made by the program, identification of high variability in clinical exposure may enhance resident self-assessment. As demonstrated previously, self-assessment when done in isolation, is an imperfect means of driving improvement but can be enhanced greatly when informed by additional information from a variety of sources.[15] Understanding the distribution of the patient encounters residents have during training, and the potential gaps in their clinical exposure, could be a potential means of allowing for informed self-assessment for a resident's clinical skills. This could be potentially further enhanced if facilitated under the supervision of faculty coaches within the program, a method that has become increasingly popular in medical education.[16,17] Future work could follow a cohort of residents who are able to track their own patient volumes more regularly than was possible in the current study and compare themselves to their peers throughout training and evaluate whether any differences in clinical competence are identified. This could also allow programs to determine the perceived value of this information to residents. Finally, residents could use this data to drive their patient selection while working in the ED.

Beyond the potential for shaping resident self-assessments, clinical exposure data may have important implications for residency program leadership as we move toward an era of competency-based medical education (CBME). Two of the pillars of CBME, "teaching tailored to competencies" and "effective programmatic assessment,"[18] lend themselves well to the identification of program clinical weaknesses as well as to the creation of new curricular experiences designed to address areas of limited clinical exposure identified by resident CC data. These experiences could potentially take the form of targeted readings or simulation sessions designed to supplement lower frequency clinical encounters.

LIMITATIONS

This was a single-center study in an urban, academic ED, and findings may not be generalizable to training programs in different environments. Additionally, the data was retrospective, making the educational utility of this information or any potential causes of variation difficult to determine.

Use of a CC to categorize each patient encounter into a clinical domain has an element of subjectivity and may have led to some encounters being miscategorized with respect to the workup done or final diagnosis. Some additional subjectivity may have been introduced by how we classified CCs that could potentially have been categorized into multiple different domains (such as "fever" or "ingestion"). This was done based on what was determined to be most likely to drive the initial workup in the department. For example, although a CC of "chest pain" could represent a cardiac or pulmonary etiology, in almost all cases, a cardiac etiology must be excluded. Therefore, it was felt that this would influence the formation and modification of the resident's illness script most heavily. It is also possible that encounters were mischaracterized due to only using the first CC listed and not considering the others if multiple CCs were listed. Like the prior limitation, it was felt that the first CC was most likely to dictate the initial ED workup. Using discharge or final diagnoses instead was considered for this study, but it was felt that the CC is more likely to drive the initial differential and diagnostic workup for the patient.

Additionally, ABEM domains may be too broad to capture important differences in exposure (e.g., two residents with the same exposure to "respiratory disorders" could have seen large numbers of pneumonia patients or, alternatively, many patients with asthma). Training is inherently variable as the EM environment differs by clinical site, day, shift, or even season. Therefore, there may have been slight differences in when individual residents were in the ED clinically or the number/type of overall ED shifts worked. It is important to note that some of the included residents' training occurred during the COVID-19 pandemic, which may have had an effect on both the variety and number of clinical exposures seen by these residents. Future work could also explore exposure based on sub-domains from the ABEM model to get a more granular look at individual resident clinical experiences rather than relying on the relatively broad domains.

Other clinical variables may also have an effect on a resident's clinical exposure, including the timing of months rotating in the ED. However, the ED did not undergo major changes in the staffing model of physicians (including residents) during this period. Also, while it is likely that more senior residents assign themselves to critically ill patients, this was felt to be unlikely to meaningfully impact our results given that data was obtained at the time of graduation. Therefore, each resident would have acted in a senior role for the same amount of time. Finally, our use of the EHR at the main clinical training site of the residency to generate the data did not capture the clinical experience at two other training sites for the residency that use a different EHR. This may have served to moderate or exacerbate the differences seen among residents. However, clinical experiences at these other sites comprised a total of only four months of the 36-month curriculum, and so it is likely that our overall findings would not have been substantially affected.

CONCLUSION

Within a single, three-year academic emergency medicine program, there was substantial variation among residents regarding the variety of patient chief complaints seen throughout residency when mapped to ABEM's Model of Clinical Practice.

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The Effect of Hospital Boarding on Emergency Medicine Residency Productivity

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Introduction: Emergency department boarding has escalated to a crisis, impacting patient care, hospital finances, and physician burnout, and contributing to error. No prior studies have examined the effects of boarding hours on resident productivity. If boarding reduces productivity, it may have negative educational impacts. We investigated the effect of boarding on resident productivity as measured by patients per hour and hypothesized that increased boarding leads to decreased productivity.

Methods: This was a retrospective study at a quaternary, urban, academic Level I trauma center from 2017–2021 with a three-year emergency medicine residency of 10–12 residents per year and annual volumes of 80,000–101,000. Boarding was defined as the time between an admission order and the patient leaving the ED. We created a multivariable mixed model with fixed covariates for year, month, day of week, resident experience, shift duration, total daily ED patients, and with residents as repeated measures. The effect of boarding was estimated after covarying out all other factors.

Results: All variables included in the model were significantly associated with changes in productivity. Resident experience has the largest effect such that for each month of residency experience, a resident adds 0.012 patients per hour (95% confidence interval [CI] 0.010–0.014). Isolating the effect of boarding demonstrated that for every additional 100 hours of boarding, a resident's productivity decreased by 0.022 patients per hour (95% CI 0.016–0.028). In the study, the median daily boarding was 261 hours; if this were eliminated (assuming a resident completes 100 10-hour shifts annually), a resident could be expected to see 56.9 more patients per year (95% CI 40.7–73.1).

Conclusion: Hospital boarding significantly reduces resident productivity as measured by patients per hour. Further studies are warranted to determine the educational impact. [West J Emerg Med. 2025;26(1.2)54–62.]

INTRODUCTION

Emergency department (ED) boarding (defined as patients admitted to the hospital but remaining in the ED) has reached critical levels and has been declared a crisis by the American College of Emergency Physicians.[1] The scope of the crisis is daunting with effects on patient care, errors, physician burnout, hospital economic stress, and ambulance diversion.[2] Increased ED boarding also leads to increases in

medication errors, time to antibiotics, time to percutaneous coronary intervention for patients with myocardial infarction, time to care for patients with acute stroke, patient mortality, and risk-adjusted hospital spending, and has effects on all levels of acuity.[3–10]

Within the context of boarding, EDs must also provide sound educational training involving both quality and quantity of patient experiences. Residency programs seek to improve efficiency and productivity in their residents throughout their training. Many variables have been associated with resident productivity including time of shift, shift length, and resident experience.[11–13] There are, however, few studies that evaluate the effect of ED crowding and boarding time on the effect of emergency medicine (EM) resident productivity.[14] If boarding decreases the number of patients seen during a residency, there may be an impact on resident education.

In this study we aimed to investigate the effect of boarding on EM resident productivity as measured by patients per hour. We hypothesized that increased hospital boarding would result in decreased resident productivity.

Population Health Research Capsule

What do we already know about this issue?
Emergency department boarding negatively impacts patient care, hospital efficiency, and physician well-being.

What was the research question?
Does increased ED boarding reduce emergency medicine resident productivity, as measured by patients per hour?

What was the major finding of the study?
For every additional 100 hours of ED boarding, a resident's productivity decreased by 0.022 patients per hour (95% CI 0.016–0.028); a resident sees 57 fewer patients per year due to boarding.

How does this improve population health?
Understanding the negative effects of boarding on productivity may help policy makers find solutions to improve patient flow, patient care, resident education, and overall health outcomes.

METHODS

Study Design and Setting

This was a retrospective study conducted at the Virginia Commonwealth University Health System, the only comprehensive Level I trauma center in Richmond, VA. During the study period from January 2017–June 2021, the total patient volumes ranged from 80,000–101,000 per year. On average, 30% of patients were admitted to the hospital, of whom 5% went to the intensive care unit. Patients <18 years of age constituted 22% of the total volume. The department is staffed with board-certified emergency physicians, and during the study period 81% of patients were seen by a resident. The remaining non-resident cases were seen by advanced practice practitioners (APP) in a low-acuity area of the ED or by attending physicians and were not included in the study. Throughout the study there was no change in this staffing model such that APPs were never competing for the same patients as residents. The department has 76 beds with 35 in an acute area, 10 in trauma/resuscitation, 10 in a mid-track area, 16 in a pediatric department, and five in a fast-track zone.

Our residency program is three years in length, and class sizes ranged from 10 residents in 2017 to 12 residents in 2021. During postgraduate years (PGY)-1, 2, and 3, residents work in the ED for 26 weeks, 29 weeks, and 35 weeks, respectively. Resident shift lengths varied from 9–12 hours with the most typical shift being 10 hours. On average, each 24-hour period had a total of 137 hours of resident coverage in overlapping shifts. The EM residents saw patients in all Emergency Severity Index (ESI) categories and were the primary physicians for all emergent patients (ESI 1 and 2). Residents cared for patients in all areas of the ED other than the low-acuity area. All residents staff patients directly with an attending physician without oversight by a more senior resident; therefore, the productivity numbers for residents in all three years of training are independent.

The study was granted exempt status by the Virginia Commonwealth University Institutional Review Board (HM20024717).

Selection of Participants

Data from all patients evaluated by an EM resident was captured in a database, and in conjunction with scheduling data it was used to determine the average number of patients per hour. Only EM residents were included. The study period was selected as this was the maximum amount of time for which data was available prior to the hospital switching to a new electronic health record. As the database was initially created to provide feedback to residents, certain data was removed and not available to us for analysis. Information from the first month of EM for each resident was not provided, and due to initial effects from the COVID-19 pandemic, data from April–July 2020 was not included.

Measurements

We combined three databases for analysis: the patient database of all ED encounters; the resident scheduling database; and the hospital boarding database.

During the study period, the EM residency program received monthly, system-generated reports listing the unique patient identifier, name of the resident assigned to care for the patient, the ESI acuity level, the date/time of first contact and check out, and the disposition. The resident assignment was derived from tracking board data, and in scenarios where multiple residents were assigned to a patient encounter, only the first resident assigned was credited for each unique patient encounter. The EM residents were scheduled for 9-hour, 10-hour, or 12-hour shifts during the study period. All non-EM residents and staff were excluded from the patient database.

Boarding data was reported daily from hospital analytics. The number of hours of boarding was defined as the time between an admission order and when the patient left the ED. Boarding hours was selected as this was the variable available to us from the hospital analytics database.

Outcomes

We designed a model to isolate the effects of ED boarding on resident productivity as measured by patients per hour. Patients per hour was defined as the total number of new patients seen during the shift divided by the duration of the shift in hours. The covariates were chosen from those found in previous studies to be related to resident productivity.[11,13,15,16] These included year, month, day of the week, cumulative residency months in training, shift duration, total patients per day, and boarding. Months in training was chosen as a continuous covariate to delineate resident experience rather than the rough classification of PGY-1, -2, or -3 based on the observation that resident productivity begins low in the PGY-1 year, increases in the PGY-2 year, and then plateaus. This monthly experience variable was modeled using cubic regression.

Analysis

We described the data using counts and percentages. Patients per hour was modeled using a multivariable mixed model, with covariates defined as fixed effects and residents as repeated measures. We used an autoregressive (AR1) covariance structure to account for the dependence between repeated measures. The fixed effects were year (reference = 2019), month (reference = 12), day of the week (reference = Thursday), resident month in training (centered on 18), total patients per day/100, shift duration, and daily boarding hours/100. We chose the year 2019 as a reference as it was the last full year of data prior to the start of the COVID-19 pandemic. December was chosen as it aligns with the 18th month of residency, which is when productivity plateaued in our model. Thursday was selected as it is thought to represent the day with the most ideal flow since it avoids weekends, Monday, and Friday patient surges, as well as Wednesday morning didactics when EM residents are not working clinically. The total patients per day, shift duration, and boarding hours were referenced at the median values in our dataset.

We estimated the effect of boarding from the marginal regression model after covarying out all other factors. Estimates are described using 95% confidence intervals. All data management and analysis were performed using SAS software (version 9.4 and JMP Pro version 17.2 (SAS Institute Inc, Cary, NC).

RESULTS

Characteristics of Study Subjects

During the study period, 263,058 patients were seen in the ED by 601 clinicians including the 80 EM residents studied. During the 49 months studied between 2017–2021, EM residents were scheduled to 16,949 shifts and were assigned 188,685 patients (Table 1). Total daily patient volume varied considerably during this time (mean 177, SD 26, range

Table 1. Characteristics of the emergency department residents' shifts and patients evaluated (January 2017–June 2021).

Characteristic	Shifts N	Patients N	(%)
Total	16,949	188,685	
Year			
2017	3,496	44,119	(23)
2018	3,955	47,569	(25)
2019 (11 months)*	4,053	47,035	(25)
2020 (8 months)†	3,101	29,191	(15)
2021 (6 months)	2,344	20,771	(11)
Month			
1- January	1,909	21,052	(11)
2- February	1,576	18,004	(10)
3- March	1,680	18,901	(10)
4†- April	1,302	15,229	(8)
5†- May	1,371	16,385	(9)
6†- June	1,337	15,191	(8)
7†- July	820	10,129	(5)
8- August	1,560	15,543	(8)
9- September	1,376	14,741	(8)
10- October	1,431	15,299	(8)
11*- November	1,062	11,639	(6)
12- December	1,525	16,572	(9)
Day of week			
Sunday	2,249	25,887	(14)
Monday	2,679	29,099	(15)
Tuesday	2,756	29,504	(16)
Wednesday‡	1,989	21,970	(12)
Thursday	2,601	27,874	(15)

(*Continued on next page*)

Table 1. Continued.

Characteristic	Shifts N	Patients N	(%)
Friday	2,525	28,785	(15)
Saturday	2,150	25,566	(14)
Shift			
7 AM to 5 PM	1,688	16,332	(9)
7 AM to 7 PM	180	2,512	(1)
9 AM to 7 PM	2,546	28,306	(15)
12 PM to 10 PM	3,386	38,586	(20)
2 PM to 12 AM	2,470	28,631	(15)
3 PM to 12 AM	3,553	41,138	(22)
9 PM to 7 AM	3,126	33,180	(18)
PGY			
PGY-1[§]	5,162	44,817	(24)
PGY-2	4,756	57,447	(30)
PGY-3	7,031	86,421	(46)
Disposition			
Admitted		74,663	(40)
Discharged		114,022	(60)

*November 2019 was excluded as the hospital information management system was down.
[†]April 2020 through July 2020 was excluded due to COVID-19 and hospital changes.
[‡]Wednesdays mornings are resident didactics.
[§]The first month of a residency was excluded (orientation month).
ESI, Emergency Severity Index; *PGY*, postgraduate year.

88–263). As indicated in the table, the ED experienced a patient count variability that changed across years, months, days of the week, shifts, and PGY level. Of all 188,167 patients seen by EM residents, 40% were admitted.

Boarding hours per day varied considerably (mean 281, SD 127, range 50.8–914.4; Figure 1). The hospital information system calculated boarding hours daily; however, across the 1,490 days studied, there were six impossible (negative) values and nine very low values. Low values were identified by large residuals in the multiple regression model. Rather than treating these as missing values, we used a multiple regression model to impute the 15 values in question.

Main Results

All the factors in the repeated-measures mixed-model were significant ($P < 0.001$). Table 2 shows the estimated effect of each term in the model. The joint effect of all the factors on resident productivity is shown in Figure 2. These profile plots show the marginal model predicted value of resident productivity on the vertical axis across all the covariates on the separate horizontal axes. The importance

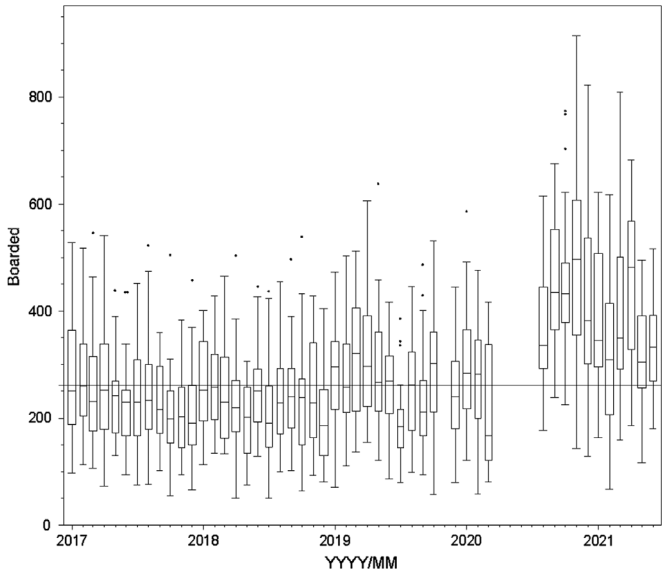

Figure 1. Boarding across study years.
Line set at median boarding hours across the entire study period (261 hours/day).
Each box plot represents a month (line = median, box = 25th to 75th quartile, whiskers = typical extremes, circles = outliers).
Note: April 2020–July 2020 hours are not available as they correspond to the beginning of the COVID-19 pandemic.

of a factor is visualized by the steepness of the prediction trace.

Isolating the effect of boarding demonstrated that for every additional 100 hours of daily departmental boarding, individual resident productivity decreased by 0.022 patients per hour (95% confidence interval [CI] 0.016–0.028, Table 2). In the reference standard scenario, a resident could be expected to see 1.10 patients per hour with boarding at the daily median (261 hours) but could see 1.15 patients per hour if boarding were eliminated (Figure 2, Panel C). Table 3 shows how resident productivity was degraded by boarding across the range of values seen at our institution. A resident would see 1.14 patients per hour when boarding was at the lowest in the study compared to 0.95 patients per hour at the maximum level of boarding seen in the study, which is a difference of 0.19 patients per hour (95% CI 0.15–0.22). Assuming a resident completes approximately 100 shifts a year that are of 10 hours duration and boarding was eliminated, then a resident could be expected to see 56.9 more patients per year (95% CI 40.7–73.1). This would represent a 5% increase in patient volume per resident annually.

Resident experience has the largest effect on resident productivity. Resident productivity was low initially at 0.5 patients per hour (95% CI 0.46–0.54) by the second month of training (Figure 2). Improvement was initially rapid to 0.75 patients per hour at seven months, then plateaued near the 18-month point (1.10 patients per hour) to finally reach 1.12 patients per hour at the end of the 36 months (95% CI 1.08–1.17). When evaluating our data by PGY level, our

Table 2. Multiple regression results predicting new patients per hour per resident for each variable.

Effect	Estimated new patients per hour	Standard error	95% CI
Intercept	1.0957	0.0173	1.0618 to 1.1297
Year			
2017	0.1501	0.0122	0.1262 to 0.1740
2018	0.0837	0.0117	0.0608 to 0.1065
2019	[reference]		
2020	−0.0641	0.0137	−0.0909 to −0.0373
2021	−0.1682	0.0156	−0.1987 to −0.1377
Month			
1- January	0.0635	0.0172	0.0298 to 0.0972
2- February	0.0776	0.0182	0.0420 to 0.1133
3- March	0.0498	0.0181	0.0144 to 0.0852
4- April	0.0840	0.0197	0.0453 to 0.1227
5- May	0.0750	0.0196	0.0366 to 0.1133
6- June	0.0585	0.0201	0.0191 to 0.0979
7- July	−0.0077	0.0219	−0.0507 to 0.0353
8- August	0.0550	0.0185	0.0188 to 0.0912
9- September	0.0654	0.0187	0.0288 to 0.1021
10- October	0.0487	0.0184	0.0127 to 0.0847
11- November	0.0486	0.0199	0.0095 to 0.0876
12- December	[reference]		
Day of the week			
Sunday	0.0587	0.0118	0.0357 to 0.0818
Monday	−0.0312	0.0118	−0.0542 to −0.0082
Tuesday	0.0122	0.0110	0.0094 to 0.0338
Wednesday	0.1094	0.0123	0.0854 to 0.1334
Thursday	[reference]		
Friday	0.0475	0.0109	0.0261 to 0.0688
Saturday	0.1182	0.0120	0.0948 to 0.1417
Resident months (linear)*	0.0122	0.0010	0.0101 to 0.0142
(quadratic)	−0.0011	0.0000	−0.0012 to −0.0010
(cubic)	0.00003	0.00001	0.00002 to 0.00004
Total patients per day (per 100 patients)*	0.4021	0.0165	0.3697 to 0.4344
Shift duration*	−0.1277	0.0070	−0.1413 to −0.1140
Boarded (per 100 hours)*	−0.0218	0.0032	−0.0280 to −0.0156

The mixed-model also included resident as a repeated-effect with an AR(1) covariance structure.
*Continuous covariates were referenced to the median value. Median resident month = 18, total patients per day/100 = 1.77, shift duration = 10 hours, boarded hours/100 = 2.61.
CI, confidence interval.

PGY-1 residents saw 0.75 per hour, PGY-2 residents saw 1.10 patients per hour, and PGY-3 residents saw 1.12 patients per hour.

Total patients per day presenting to the ED was the next most important factor in resident productivity. For every 100 new patients presenting to the ED, an individual resident would be expected to add 0.40 patients per hour (95% CI 0.37–0.43). The median value for daily total patient volume was 177 patients per day, but a low-volume day at the 10th percentile (143 total patients) resulted in a corresponding decrease in resident productivity to 0.96 patients per hour (95% CI 0.92–1.00). For a high-volume day at the 90th

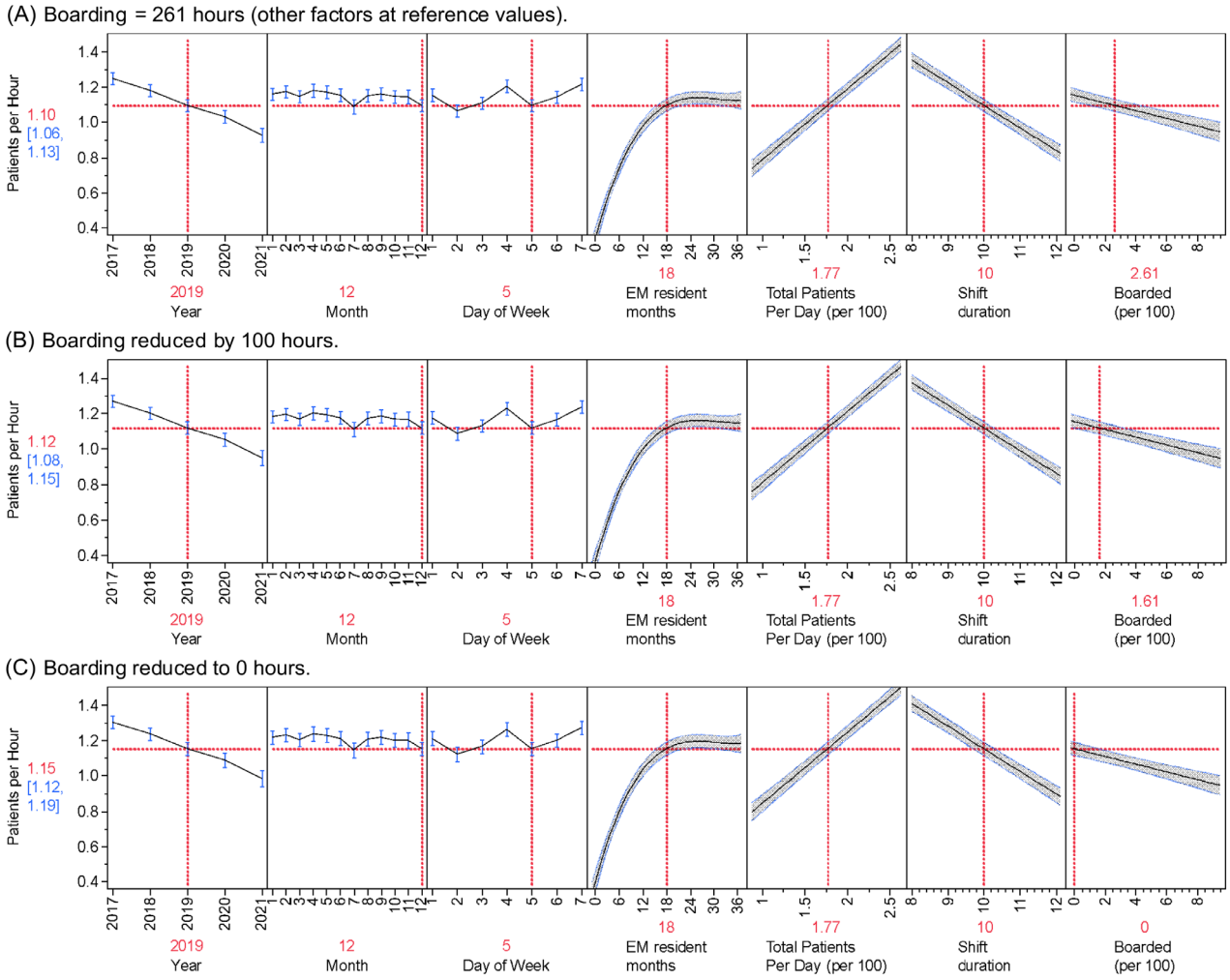

Figure 2. Multiple regression results predicting new patients per hour per resident for each variable.
All values (year, month, day of week, EM resident months, total patients, shift duration) in model held at reference standards with adjustments to boarding (last panel of each graph). Expected patients per hour in each scenario is indicated by the red number in the Y axis with 95% confidence intervals in blue. As boarded hours change (last panel of each graph) so do patients per hour (red number to left of each graph) in each of the three scenarios (A: Median boarding of 261 hours. B: Reducing boarding by 100 hours. C: Eliminating boarding hours.)

percentile (210 patients), resident productivity increased to 1.23 patients per hour (95% CI 1.19–1.26).

Resident productivity also changed based on the year, shift duration, and day of the week. Resident productivity was highest in 2017 at 1.25 patients per hour (95% CI 1.21–1.28) and steadily decreased to the 0.93 patients per hour seen in 2021. Resident productivity for a nine-hour shift was predicted to be 1.21 patients per hour

Table 3. Estimated resident productivity by boarding hours.

Cutoff	Boarded (hours)	Estimated patients per hour	Standard error	95% CI
Maximum	914	0.954	0.027	0.900 to 1.007
75th percentile	351	1.076	0.018	1.042 to 1.111
Median	261	1.096	0.017	1.062 to 1.130
25th percentile	189	1.111	0.017	1.077 to 1.146
Minimum	51	1.141	0.018	1.105 to 1.178
No boarding	0	1.153	0.019	1.115 to 1.190

Marginal estimates from the mixed model with the following factors held constant: year = 2019, month = 12, day of the week = 5 (Thursday), resident month in training = 18, total patients per day/100 = 1.77, shift duration = 10 hours.
CI, confidence interval.

(95% CI 1.19–1.26), whereas for a 12-hour shift it was predicted to be 0.84 patients per hour (95% CI 0.80–0.89). Saturdays and Wednesdays averaged approximately 1.21 patients per hour, Sundays, and Fridays approximately 1.15 per hour, and Mondays, Tuesdays, and Thursdays 1.10 patients per hour.

Month-to-month variability had the smallest effect on resident productivity. Compared with the other months, July and December had lower resident productivity (1.09 vs 1.16 patients per hour).

DISCUSSION

To our knowledge, this is the first study to demonstrate that there is a significant reduction in resident productivity (measured as patients per hour) due to hospital boarding in the ED. In our model, this resulted in a decrease of 0.022 patients per hour (95% CI 0.016–0.028) for every 100 hours of daily boarding. While performed at a single institution, our dataset broadly aligns with multiple studies previously completed regarding resident productivity. In our study, we analyzed resident experience as the number of months in training rather than divided into PGY level. This was based on our observation that productivity rapidly increased during the PGY-1 year and then plateaued in the middle of the PGY-2 year.

When evaluating our data by PGY level, our PGY-1 residents saw 0.75 patients per hour, PGY-2 residents saw 1.10 patients per hour, and PGY-3 residents saw 1.12 patients per hour. Prior studies have demonstrated similar patterns with PGY-1 to -3 residents seeing between 0.79–0.81 patients per hour, 1.05–1.2 patients per hour, and 1.22–1.27 patients per hour, respectively.[17–19] A study by Henning et al showed rapid progression from PGY-1 to PGY-2 year and then gradual progression in PGY-3 year but was based on patients per day.[20] Similarly, a study by Turner-Lawrence and Todd saw increasing productivity from 1.2 patients per hour to 1.5 patients per hour to 1.6 patients per hour by PGY-1 to -3 residents, respectively.[13] While these productivity numbers are higher than those in our study, the authors did not adjust for additional variables.

In a more comparable study, Kirby et al reported the efficiency of EM residents during ED crowding.[14] The authors used the National Emergency Department Overcrowding Study (NEDOCS) scoring system to categorize states in the ED as not crowded, crowded, and overcrowded. They found that resident productivity measured as new patients per hour increased initially in all year groups as the ED transitioned from not crowded to crowded, but then remained stable when transitioning from crowded to overcrowded. While the NEDOCS score uses a measure of ED boarding (the waiting time of the longest admitted patient), it does not include total patient boarding hours as in our study. Our study more directly examines the effect of boarding (one element of crowding) on resident productivity. The paradoxical increase in resident productivity in the Kirby study may have been due to an increased number of patients presenting to the ED, which could have increased the NEDOCS score. Our study demonstrated that resident productivity increased with higher patient volumes, and including this in our model allowed us to better isolate the effect of boarding.

According to a study by the Academy of Administrators in Academic Emergency Medicine and the Association of Academic Chairs of Emergency annual benchmark survey, boarding times have dramatically increased since the COVID-19 pandemic.[21] By the end of their study period, the median number of boarding hours per month was 11,480, which approximates to 382 hours of daily boarding. In our study, which includes a pre-pandemic period, the median daily boarding was 261 hours, suggesting that boarding is likely worsening over time and is a problem at many academic medical centers.

The educational impact of decreased patient volumes caused by boarding is uncertain. It is reasonable to expect that residents seeing fewer cases may lose valuable learning opportunities, but this has not been well studied and no firm numbers exist to suggest a threshold at which education suffers. Prior authors have surveyed residents regarding a perceived decrease in education during crowding.[22,23] These studies concluded that residents did not perceive a difference in education during these times, but they used differing measures of crowding, were survey-based, and underpowered. Educators may switch to different models of teaching during periods of high boarding, leading to residents perceiving a less deleterious effect.[24]

Others have postulated an educational Starling effect whereby some boarding allows supervising physicians more time to teach, but at some point there are diminished returns as fewer new patients become available to discuss.[25] A more recent study was conducted during the current boarding epidemic; the authors surveyed EM program directors regarding their perceptions of the impact of boarding on resident training.[26] In this study, 80% of the respondents felt that boarding negatively affected resident education, especially in the domains of managing department throughput and managing high volumes of patients per resident. While survey-based in nature, the study results broadly aligns with the prior studies in this area.

Theoretically, residents who see fewer cases may lose valuable learning opportunities. While the components of Bloom's domains of educational activities can be learned via different modalities of instructional techniques, clinical experience allows for the linking of knowledge to skills and then to attitudes/emotions.[27] By decreasing a learner's exposure to patients, one could argue that residents may lose valuable experiential learning opportunities. While some of these can be replicated in simulation or case-based discussion, other skills cannot and are best learned via hands-

on, experiential learning encounters. Experiential learning theory, as described by Kolb, highlights the importance of real-life experience and the influence this has on learning.[28] Unlike traditional learning and instructional methodology that focuses on rote memorization, experiential learning is an active process where residents are engaged in concept transformation through action as well as reflection on their experiences and patient encounters.

This learning theory also emphasizes principles of adult education in which prior learning experiences can be leveraged to create more meaningful and relevant educational experiences.[29] Additionally, decreasing patient interaction may also affect residents' application and translation of knowledge into practice. Behavioral learning theory emphasizes learning through interactions with the environment where reinforcement and feedback can encourage modification of behaviors. By incorporating behavioral learning strategies, medical education can foster not only technical competencies but also the development of professional habits such as effective communication between team members and patients.[30]

LIMITATIONS

This study has several limitations. This was a single-center study that took place in a high acuity, quaternary-care center that also experiences high levels of boarding, which may limit generalizability to other centers. The database that captured the resident patient assignment was based on tracking board data and may have occasionally miscredited a resident with a patient encounter; however, as the dataset was large and involved multiple years with complete datasets for three full classes of residents this is unlikely to have greatly influenced the data. Our resident class size did increase during the 2021 year and thus could theoretically have decreased the number of patients available per resident. While we did not study that directly, it is unlikely to have impacted the data greatly as the additional residents allowed for the creation of an outside rotation at a free-standing emergency center and, therefore, resident staffing hours stayed generally consistent at the study site.

Our model did not include a measure of patient acuity as a covariate. While the ESI category and disposition were recorded for each patient, we did not feel there was a reliable way to convert this data into a meaningful measure of hourly acuity that influenced the amount of time a resident might dedicate toward patient care. For example, an ESI-1 patient who is admitted for an ST-segment elevation myocardial infarction may stay in the department for 15 minutes leaving the bed open for a new patient, while an ESI-3 patient requiring a workup for abdominal pain including imaging who is discharged may occupy a room and a resident for multiple hours. Since our dataset was large, it was assumed that all residents would be exposed equally to the same mix of acuities on individual shifts, by the end of their residency and thus limit the effect on the data. Additionally, recent studies have called into question the accuracy of the ESI.[26,27] A prior study on resident productivity did not show a correlation between ESI and clinician disposition times.[14]

Our study also included data from the COVID-19 pandemic, which affected patient volumes and ED boarding. The dataset we used was initially meant for reporting individual residents' productivity measures, so data from the first few months of the pandemic was not available for our current study. This likely served to decrease the effect of the initial pandemic response on our data. Just prior to the pandemic our ED had seen a growth in patient volumes from 87,000 patients per year to a peak of 101,000 patients per year, which was followed by a rapid decline to 83,000 a year in the 2021–2022 year. The volumes did slowly rise after the study period. This may have influenced some of the data from our later resident-year groups and served to decrease productivity.

Our measure of boarding may also have limitations. Total boarding hours per day was the variable available from our hospital analytics department. The number of boarded patients per day may have provided different data. For example, in our model a single behavioral health patient boarding for 20 hours from one day would be indistinguishable from 20 patients boarding in 20 individual rooms for a single hour each. As the dataset is large, and all residents were exposed to the same conditions throughout their time, it is unlikely any one resident's data (or the trend) would be affected based on these types of outliers.

CONCLUSION

We found a significant reduction in resident productivity as measured by patients per hour during periods of increased boarding. Further studies are warranted to determine the educational impact of these findings.

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Palliative Care Boot Camp Offers Skill Building for Emergency Medicine Residents

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BACKGROUND

Emergency medicine (EM) residents routinely care for critically ill patients in both the emergency department (ED) and intensive care units.[1] Proficiency in primary palliative care skills is essential for all emergency clinicians.[2,3] However, a significant number of residents lack exposure to formal education and training in palliative care.[4,5] Moreover, education and training in palliative care encompasses several Accreditation Council for Graduate Medical Education (ACGME) competencies including system navigation for patient-centered care, understanding the physician's role in the healthcare system, patient- and family-centered communication, and interprofessional and team communication.[6]

Current curricula addressing primary palliative care skills in EM are notably limited.[7–12] Historically, our residency experienced inconsistencies in the teaching of primary palliative care skills. They were sporadically covered during regular conferences or left to develop organically over time. Furthermore, postgraduate year-2 (PGY-2) residents, who primarily manage seriously ill patients, found themselves engaging in challenging serious-illness conversations with patients and families with little to no training. Recognizing the imperative for more comprehensive education, we introduced a four-week, intensive primary palliative care curriculum specifically tailored for EM PGY-2 residents that was entitled "Palliative Care Bootcamp."

OBJECTIVES

The overall objective of the bootcamp was to introduce and strengthen primary palliative care skills among PGY-2 residents at an independent academic medical center. At the end of the curriculum, residents would be able to 1) define the scope of hospice and palliative medicine; 2) understand what primary palliative care skills are for non-specialty trained physicians; 3) recognize ED patients with palliative care needs; 4) implement a hospice evaluation; 5) understand how interdisciplinary teams are involved in the care of seriously ill patients; and 6) build communication skills for discussing goals of care (GOC).

CURRICULAR DESIGN

The curriculum and assessment were exempt from the institutional review board. Using Kern's six-step approach to curriculum development, we created an introductory primary palliative care curriculum. An EM faculty member with an interest in palliative care and residency leadership collaborated to develop the curriculum. The residency program endorsed the curriculum as it aligned with a curriculum redesign to include more PGY-specific education.

The curriculum was initially developed in 2017. The interdisciplinary palliative care team at the study institution served as content experts. The team performed a broad review of the residency curriculum and prioritized high-yield topics tailored to the local context. Sessions were scheduled during weekly conference and spanned four consecutive weeks. This schedule allowed for an intensive experience and allowed for rapid skill development. The curriculum is strategically delivered early in the PGY-2 year to leverage residents' existing experience in caring for seriously ill patients and facilitate meaningful reflection and inquiry.

The curriculum is structured in two phases (Table 1). The first phase spans three weeks and consists of three two-hour sessions. These sessions are dedicated to primary palliative care fundamentals such as an introduction to palliative care, prognosis and trajectory, and non-pain symptom management. Session facilitators included the EM faculty content expert as well as members of the institutional palliative care team, the director of chaplaincy who specialized in family support, the director of palliative care, and the palliative care fellow. Each session encompassed a didactic segment, interactive case-based discussions using scenarios prepared by facilitators or contributed by residents, and opportunities for resident questions.

In the final week, residents engaged in a four-hour session in the simulation center. This session was led by the EM content expert who is a trained facilitator with Vital Talk, a national non-profit that promotes evidence-based education in serious-illness communication.[13] This session involves using a standardized patient. Residents are assigned to a

Table 1. The breakdown of palliative care bootcamp sessions by hour detailing the topic, learning objectives, mapping to ACGME* competencies, and the format of the session.

Hour	Topic	Objectives	ACGME competencies	Format/facilitator
1	Intro to primary palliative care in emergency medicine	Define primary palliative care and identify common ED presentations of patients with unmet palliative care needs. Define advance care planning, goals of care, code status and treatment limitations and describe how these are codified in legal and medical documents Interpret a POLST (Physician Orders for Life Sustaining Treatment) form and describe its use in acute care settings	*System navigation for patient centered care* *Physician role in healthcare systems*	Lecture – EM faculty content expert
2	Prognosis and trajectory	Describe four common trajectories of life-limiting illness Define prognosis and describe 3 strategies to assess prognosis in ED patients with serious illness	*Diagnosis, treatment, and clinical reasoning*	Case-based learning – EM content expert
3	Chaplain chat	Describe the role of the chaplain in the interdisciplinary care of seriously ill patients in the ED	*System navigation for patient-centered care* *Interprofessional and team communication*	Case-based learning – chaplain
4	Non-pain symptom management	Choose appropriate first- and second-line treatment for seriously ill patients experiencing nausea and vomiting in the ED Choose appropriate first- and second-line treatment for seriously ill patients experiencing dyspnea in the ED Choose appropriate first- and second-line treatment for seriously ill patients experiencing constipation in the ED	*Pharmacotherapy* *Diagnosis, treatment, and clinical reasoning*	Case-based learning – hospital palliative care specialist
5	Ask a consultant	Describe the role of the HPM clinician in the care of seriously ill patients in the hospital Understand the role of HPM consultation in the emergency department	*Interprofessional and team communication*	Case-based learning – hospital palliative care specialist
6	Intro to hospice	Describe the scope of hospice services and the settings where it can take place Identify patients who may qualify for hospice and how to get them evaluated Provide goal concordant care to patients enrolled in hospice who present to the ED	*System navigation for patient-centered care* *Physician role in healthcare systems*	Lecture – community hospice medical director
7–10	Serious illness communication workshop (VitalTalk)	Practice skills associated with goals of care conversations with a simulated patient.	*Patient- and family-centered communication*	Simulation and standardized patient skills-based practice – EM content expert

**ACGME*, Accreditation Council for Graduate Medical Education; *ED*, emergency department; *EM*, emergency medicine; *HPM*, hospice and palliative medicine.

small group and they role-play delivering serious news with EM-based scenarios. This session builds skills around delivering serious news.

The curriculum underwent iterative adjustments informed by informal feedback from both facilitators and residents. Modifications were made based on facilitator availability and interest, resulting in the inclusion or modification of topics, while certain subjects, such as opioid pain management, were removed due to redundancy in other educational settings.

SURVEY DEVELOPMENT

Before implementing the curriculum, we created a brief, pre-bootcamp survey to assess residents' prior exposure and familiarity with palliative care. Subsequently, two post-surveys were used to gauge residents' perceptions regarding the achievement of session-specific goals. We developed the first survey to evaluate the first three weeks of the bootcamp. The initial development collected all potential survey items that were refined through expert consultation. The survey used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The survey items had been pilot tested and refined in preceding years to ensure question clarity (Appendix 1).

A second survey, which was used for the simulation-based session, prompted residents to rate their self-assessed confidence surrounding the specific skills on conducting GOC conversations covered in the session (Appendix 2). The survey uses a five-point Likert scale ranging from 1 (not very confident) to 5 (very confident).

IMPACT/EFFECTIVENESS

The curriculum evaluation took place during the 2022 bootcamp. Each session had an average of 8–10 PGY-2 residents, of a total 17 potential participants. Attendance varied from week to week due to excused absences. Participation in both pre- and post-surveys was voluntary. Of the eligible residents, nine (52%) completed the pre-survey, revealing that all but one resident had prior exposure to a palliative care rotation during medical school, and 7 of 9 respondents (77%) reported previous communication skills training during their PGY-1 year.

Post-intervention surveys were collected after each session, with completion rates ranging from 25% (2/8 participants) to 70% (7/10 participants) per session. Notably, all respondents indicated agreement or strong agreement with the achievement of each session's objectives. For the simulation-based communication session, 88% (8/9) reported increased confidence overall, 88% (8/9) of residents reported increased confidence in responding to strong emotions, and 100% (9/9) reported enhanced confidence in eliciting patient goals and values.

TIPS FOR SUCCESS/CHALLENGES/LESSONS LEARNED

Several key themes emerged regarding the implementation of a bootcamp curriculum in primary palliative care for EM residents. One notable advantage of this curriculum is its longitudinal format, spanning four consecutive weeks with short intervals between sessions. This structure affords residents the opportunity to practice newly acquired skills while actively working in clinical settings, fostering continuous reflection and refinement of their abilities. Additionally, the curriculum is adaptable and enables its implementation in programs lacking EM palliative care-trained faculty. Programs can use local resources such as institutional palliative specialists, interdisciplinary palliative teams, or several publicly available online resources.[9,10,14]

However, despite its strengths, our curriculum faces several challenges. Notably, residents unable to attend sessions risk missing valuable educational opportunities, as the curriculum is not repeated during the academic year. Moreover, limited opportunities for ongoing skill acquisition and feedback outside scheduled sessions may hinder residents' ability to fully integrate palliative care principles into their practice. Furthermore, individual programs may be unwilling to invest 10 hours of curriculum to this specific topic and skillset. Lastly, while there was no cost for the simulation time and standardized patients at the study institution, there may be cost associated with this in other programs and this must be considered.

Furthermore, while participants expressed satisfaction with the curriculum, the outcomes data lack the rigor necessary to definitively establish its success. The impact of this curriculum on long-term knowledge or clinical behavior within the ED remains uncertain. It will be important to conduct more formal assessments of the curriculum objectives and to evaluate its application in the clinical setting.

CONCLUSION

As the role of primary palliative care in emergency medicine continues to evolve, there is a growing need to integrate these essential skills and concepts into all EM residencies. The bootcamp format has proven to be a valuable educational tool in our program, and its effectiveness warrants further exploration and dissemination within the broader EM community.

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Making A Difference: Launching a Multimodal, Resident-Run Social Emergency Medicine Program

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Introduction: Social medicine seeks to incorporate patients' social contexts into their medical care. Emergency physicians are uniquely positioned to address social determinants of health (SDoH) on the frontlines of the healthcare system. Miami-Dade County (MDC) is a diverse and socially vulnerable area. In 2020, the University of Miami-Jackson Health System (UM-JHS) emergency medicine (EM) residency program launched a multimodal, resident-led Social EM program to identify and address SDoH in the emergency department (ED).

Methods: We use a four-pillar approach to SDoH in the ED: Curriculum Integration; Community Outreach; Access to Care; and Social Justice. Residents graduate with a knowledge of Social EM principles through an 18-month curriculum, an elective, and a longitudinal track. We developed sustainable initiatives through interdepartmental and community-based partnerships, including a Narcan distribution initiative, an ED-based program linking uninsured patients to follow-up care, a human trafficking education initiative, and a quality improvement initiative for incarcerated patients.

Results: Given that the 18-month curriculum was launched in 2022, a full rotation of the curriculum had not been completed as of this writing, and data collection and analysis is an ongoing process. The initial pretest and post-test survey data show improvement in knowledge and confidence in managing Social EM topics. The Narcan initiative has screened 1,188 patients, of whom 144 have received Narcan. The ED-based patient navigation program has enrolled 31 patients to date, 18 of whom obtained outpatient care. Analysis of the impact/effectiveness of the program's other initiatives is ongoing.

Conclusion: To our knowledge, this is one of the most robust social EM programs to date, as many other programs primarily focus on service opportunities. Rooted in the revised principles of Bloom's taxonomy of cognitive learning, this program moves beyond understanding Social EM tenets to generating solutions to address SDoH in and outside the ED. [West J Emerg Med. 2025;26(1.2)5–13.]

BACKGROUND

Social medicine, or the incorporation of patients' social contexts into their medical care, has become a vibrant, interdisciplinary movement that has gained traction in medical schools, residencies, and at the national level. Social medicine emphasizes the importance of social determinants of health (SDoH), or "the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks."[1] The US Department of Health and Human Services lists five core SDoH to consider during patient care: economic stability; education access and quality; healthcare access and quality; neighborhood and built environment; and social and community context.[1]

Although SDoH can be applied to all specialties, they are perhaps most relevant to emergency medicine (EM). Passage of the Emergency Medical Treatment and Labor Act (EMTALA) in 1986[2] was acknowledgment that emergency

physicians are often the only link to the healthcare system for patients with financial limitations. Emergency physicians are estimated to provide two-thirds of acute care for all uninsured patients and half of acute care for all Medicaid patients.[3] Whether they are rushing a patient to CT, leading their team during a resuscitation, or evaluating patients in a crowded hallway, emergency physicians are immersed in longstanding, complex social issues: trauma; poverty; homelessness; mental health disorders; etc. Therefore, recognizing the effects of SDoH on patient care is critical in the ED.

Jackson Memorial Hospital (JMH) is the primary training site for the University of Miami-Jackson Health System (UM-JHS) EM residency program. It is also the third largest public hospital in the country. The UM-JH Social EM program was launched in 2020 to improve the incorporation of patients' social contexts into their care.

Needs Assessment

When designing a Social EM program, keeping the residency's location and patient population in mind is important. Like most EDs across the nation, the JMH ED is a place of refuge for patients whose SDoH may prevent them from obtaining care elsewhere. As a safety-net hospital in the seventh most populous county in the nation,[4] JMH serves a particularly diverse patient population with striking socioeconomic needs. The UM health system conducted formal needs assessments of Miami-Dade County (MDC) from 2019–2022, and the UM-JHS Social EM program was designed to reflect these needs.[4,5]

The UM-JHS Social EM program was designed to ensure that all residents graduate with the ability to incorporate their patients' SDoH into ED care regardless of their ultimate practice locations. However, certain aspects of this program were designed to address the unique needs of MDC—a "minority-majority" community that experiences challenges with English proficiency, and in which 20% of the population lives below the poverty level.[4,5]

PROGRAM GOALS

Bloom's taxonomy of cognitive learning objectives outlines six levels in the cognitive domain: knowledge; comprehension; application; analysis; synthesis; and evaluation.[6] Over time, scholars have sought to revise this framework and, when taken as a whole, these revisions place less emphasis on a linear progression through each level.[6] Instead, there is an increased focus on generating new hypotheses and developing projects that use and expand upon the acquired knowledge.[6] Therefore, the UM-JHS Social EM program seeks to shift its participants from purely understanding SDoH as they pertain to EM, to generating effective solutions for addressing these SDoH in and outside the ED. The Social EM program outlines six goals for its residents, who are then tasked with generating effective solutions and designing their own measurable outcomes for each goal. Upon successful completion of this program, residents should be able to:

1. Define and identify SDoH in the ED and apply these principles to bedside care.
2. Engage with MDC outside the ED and address its social and medical needs through longitudinal involvement in local outreach initiatives.
3. Solidify and share acquired knowledge through an 18-month, multimodal curriculum.
4. Identify and seek to address barriers to medical care experienced by patients who use the ED as their main source of healthcare.
5. Identify and seek to address recurrent social justice issues encountered in the ED.
6. Enact positive change through advocacy and quality improvement initiatives at hospital-wide, local, and/or national levels.

PROGRAM PARTICIPATION

Since its launch in 2020, the program has been divided into four pillars that address core areas within Social EM: Curriculum Integration; Community Outreach; Access to Care; and Social Justice (Figure 1). Initiatives within each pillar will be discussed in a separate section. Anyone affiliated with the UM-JHS ED can participate in initiatives across all four pillars. Many of these initiatives are longitudinal, allowing for varying levels of participation throughout residency. Additionally, this program also offers leadership, peer teaching, and scholarly opportunities that may count toward existing residency requirements.

The UM-JHS has a three-year EM residency program, and each of its classes (postgraduate years [PGY] 1–3) is comprised of 14–15 residents. EM residents are not required to participate in the Social EM program but are encouraged to do so. They may choose to serve as program leaders (Figure 1), participate in the longitudinal track and/or two-week elective (discussed in detail in subsequent sections below), or to participate in individual initiatives as their schedules allow. However, Social EM program leadership developed a formal curriculum to ensure that all residents graduate with a solid understanding of core Social EM principles, regardless of their level of involvement with the program; this will be discussed in a separate section.

CORE LEADERSHIP HIERARCHY

This program was designed to be executed by residents in collaboration with faculty, medical students, and staff. The program was structured into a core leadership hierarchy to appropriately divide the labor of designing and launching initiatives that pertain to each pillar, while ensuring that residents complete their existing clinical and academic

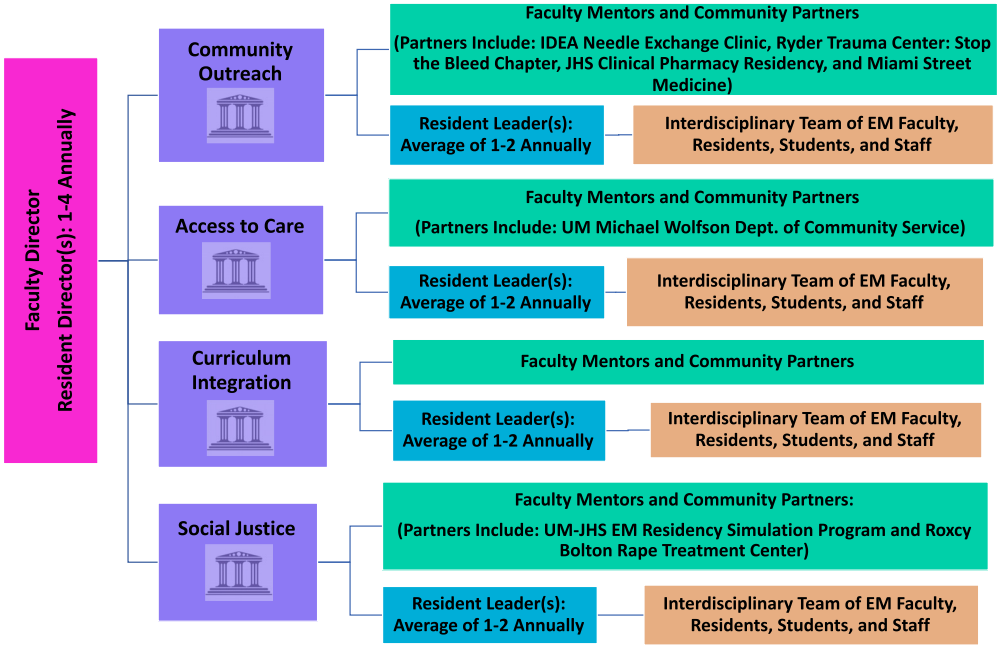

Figure 1. Social emergency medicine program organization and division of labor. Program directors consist of one faculty director and 1–4 resident directors (EM residents selected via a formal application process). Program directors oversee initiatives across all four pillars but spend additional time leading Curriculum Integration initiatives to ensure a seamless incorporation of Social EM principles into residency training. Pillar leaders are EM residents who are selected by program directors via a formal application process; they design and oversee initiatives in their assigned pillars. Faculty mentors are generally core faculty in the EM department with expertise in their assigned pillar. However, faculty in other specialties at UM-JHS may also serve as mentors if they currently oversee a community or hospital-based initiative that collaborates with the Social EM program. (For example, a faculty mentor from the family medicine department oversees the IDEA Needle Exchange Clinic.) Anyone affiliated with the EM department may serve as a team member. Team members work directly with their assigned resident leaders and divide the tasks required to launch and publicize initiatives.

requirements (Figure 1). This leadership hierarchy organizes, executes, and publicizes the program and its initiatives.

Directors

A faculty director and at least one resident director oversee the program together (Figure 1). The original directors, Patricia Panakos, MD, and Naomi Newton, MD, authored this paper and conceptualized the program together in Fall 2020. The collaboration between Drs. Panakos and Newton was borne from a shared passion for social medicine and a desire to implement an EM residency-based program to address the SDoH of patients in MDC. Dr. Panakos is the associate program director for the UM-JHS EM residency and has undergone formal training in curriculum development. She has also developed ED-based public health initiatives at JHS, such as a universal screening program for communicable diseases, including HIV, hepatitis C, and syphilis. Dr. Panakos continues her role as faculty director for the social EM program. Dr. Newton is an alumna of the UM-JHS EM residency and served as chief resident during her final year of training. She assumed the role of the social EM program's resident director as a PGY-1 and transitioned her position upon her graduation in 2023. She has also collaborated with Dr. Panakos on public health initiatives, including a universal HIV screening initiative in JHS's pediatric ED. Dr. Newton is currently pursuing a two-year fellowship in health policy and advocacy at Emory University.

Given that there was no precedence for such a program at UM-JHS, Drs. Panakos and Newton worked almost daily to create the program and maintain its sustainability, while also completing their existing clinical and academic responsibilities. Drs. Panakos and Newton designed the program's overall structure, created a formal selection process for pillar leaders, and identified community partners and faculty mentors with expertise in Social EM. They presented a formal proposal that was approved by both the chair of the ED at JMH and the UM-JHS EM residency program director in October 2020. They also designed and launched the 18-month curriculum, two-week elective, and longitudinal track, which are described in subsequent sections of this paper. To account for continued program growth, the original directors selected four new resident directors for the 2023–2024 academic year via a formal application process (Figure 1).

Directors approve proposed initiatives across all pillars and work directly with pillar leaders to track progress and troubleshoot challenges. They check in remotely with pillar

leaders at least bi-monthly to ensure timely project completion. They also promote the program at a departmental and hospital-wide level and help pillar leaders identify faculty and community partners (Figure 1). Resident directors are recognized with a Social EM leadership award upon their graduation.

Resident Leaders

An average of two PGY-1 or PGY-2 EM residents lead each pillar. Interested residents apply for this position via a brief electronic application (Google Survey) at the start of the academic year and are selected by the directors. Residents generally do not serve as leaders of more than one pillar, as this position must be balanced with existing residency obligations. Resident leaders report directly to the directors and dedicate an average of two to four hours per week to their roles. As leaders progress through training, they may either remain in their leadership roles or transition their roles to incoming PGY-1s and PGY-2s. All resident leaders who have served for at least one year are recognized with a special award upon graduation from residency.

Leaders focus on designing initiatives that pertain to the goals of their assigned pillar. They identify appropriate partners within JHS and MDC to aid in developing and launching these initiatives (Figure 1). Partners include JHS faculty (including those in non-EM specialties), local outreach organizations (many of which already had established relationships with UM-JHS through medical student involvement), and other JHS-affiliated residency programs (eg, pediatrics, internal medicine, family medicine). Interdisciplinary collaboration prevents the Social EM program from "re-inventing the wheel" and helps initiatives achieve success with fewer funding, resource, and logistical restrictions. Resident leaders delegate day-to-day tasks to an interdisciplinary team to divide the labor of executing these initiatives. Leaders are required to check in remotely with their team members at least monthly to discuss progress on pillar initiatives.

Interdisciplinary Teams

Team members divide the tasks required to launch initiatives within their assigned pillar. They are required to dedicate a minimum of one to two hours per week on these tasks and check in regularly with their pillar leaders as previously discussed. Those who desire to do so may participate in more than one pillar team. Participation in a pillar team is open to anyone in the UM-JHS ED. However, during the first three years of the program, teams were primarily comprised of EM-bound UM medical and pharmacy students, JHS clinical pharmacy residents, and hospital staff (eg, nurses and social workers).

PROGRAM DESIGN: THE 4-PILLAR APPROACH

In the following section, we provide a broad overview of each pillar's objectives and highlight several key initiatives within each pillar. When relevant, please see the corresponding appendices for additional details.

Curriculum Integration

This pillar incorporates the tenets of Social EM into residency training to empower future generations of emergency physicians to apply Social EM principles to their care. This is the only pillar that requires all EM residents to participate because its initiatives have been incorporated into the existing residency curriculum. Doing so ensures that all EM residents graduate with an understanding of SDoH and the principles of Social EM, regardless of their level of involvement in other pillars. Of note, approval from the institutional review board was not required for the development of this curriculum.

We developed and launched a multimodal, 18-month Social EM curriculum that has been incorporated into the existing 18-month residency didactic schedule (Appendix A). The curriculum covers 18 core social EM topics (Table 1) and includes journal clubs, simulation cases, lectures, problem-based learning, and interactive group discussions. The curriculum is led by faculty and residents with expertise or

Table 1. 18 core areas of study were chosen to be covered monthly during the 18-month Social EM curriculum. This curriculum is integrated into standard residency didactic schedule, which repeats every 18 months. Using a multimodal learning format, topics can be presented as traditional lectures, case-based discussions and journal clubs ("Cases"), or simulations. The initial modalities for each topic are listed below; the modalities used for each topic will change every 18 months (eg, the pediatric health lecture would be presented as either a case or simulation 18 months later). Additional details regarding logistics and implementation can be found in Appendix A.

Lectures	Cases	Simulations
1. Social determinants of health	7. Implicit bias/racism	13. Human trafficking and domestic violence
2. Healthcare coverage and access	8. Homelessness	14. Substance abuse and harm reduction
3. Financial stability	9. Health literacy	15. Caring for incarcerated patients
4. Frequent ED utilizers	10. Immigration	16. Highly communicable diseases/STI epidemics
5. Women's health	11. Resource insecurity	17. Language and cultural barriers to healthcare
6. Pediatric health	12. Trauma-informed care	18. Gender identity

ED, emergency department; *STI*, sexually transmitted infection.

interest in the core topics. Social EM leadership assists presenters in identifying learning objectives for each session, selecting topics, and developing content. All conference attendees participate in pre- and post-surveys to assess their baseline knowledge and the effectiveness of each didactic session. Residents are also asked to evaluate the Social EM curriculum during the annual residency program evaluation. Surveys and results are discussed further in the Impact/ Effectiveness section of this manuscript.

In 2022, we launched the two-week Social EM elective for residents who desire a more in-depth experience with the program (Appendix B). This elective is open to PGY-2 EM residents during their elective block and is comprised of service opportunities, self-directed study, peer teaching, and initiative participation across all pillars. The PGY-2 rotation schedule is designed so that only one resident completes an elective in any given month. Therefore, the experience is personalized for each participating resident. Social EM directors work with the resident ahead of time to design an elective schedule that ensures participation across all pillars but allows them to engage more deeply within their pillar(s) of interest (Appendix B).

We also designed a longitudinal track that was launched the 2023–2024 academic year. Track participants engage in a set number of outreach events, quality improvement initiatives, peer teaching, and self-directed study over 18 months. The requirements are based on a point system that ensures engagement with all pillars but allows for deeper exploration in areas of individual interest. Residents must reach a minimum of 30 points to complete the track (Figure 2). Requirements include a longitudinal scholarly activity that culminates in a presentation at the local, regional, or national levels (eg, developing a project to address food insecurity). They must also participate in the Social EM didactic curriculum through peer teaching, developing new elements to the curriculum, and mentoring medical students. Participants log their progress via an online form and must attend a minimum of nine monthly track meetings with the Social EM directors over an 18-month period. Upon graduation, residents who complete the track will receive a Distinction in Social EM.

Community Outreach

This pillar was designed to establish a meaningful presence in MDC beyond bedside care and to address social issues through partnerships with local organizations. For example, through a partnership with Miami Street Medicine, participants join an interdisciplinary team in providing

Activity	Hours Spent	Personal investment value	Total Points
Caring with Compassion Module	4	0.5	2
Leadership of a Pillar	12	1.5	18
IDEA Clinic	4	0.5	2
Miami Street Medicine	3	0.5	1.5
DOCS Fair	5	0.5	2.5
Stop the Bleed Training Program	2	0.25	0.5
Stop the Bleed Lecturing	3	0.5	1.5
Coordinating care for 6 patients	4	0.25	1
Writing a high utilizers brief	2	0.5	1
Food Insecurity - Distribution Event	4	0.5	2
Human Trafficking Training Program	2	0.25	0.5
Human Trafficking Lecturing	1	0.5	0.5
Developing/Updating QI Protocol	4	1	4
Attending advocacy event	6	1	6
Developing a case/sim	4	0.75	3
Developing a lecture	6	1	6
Presenting article at JC	2	0.5	1
Peer-reviewed publishing in Social EM	8	1.5	12
Non-peer reviewed publishing in Social EM	4	1	4
Developing a new Social EM project	12	1.5	18
Social EM Elective	4	1	4
Attending track meetings	1	0.25	0.25
*Other pre-approved social EM activity	Varies	Varies	Varies
		Total	91.25
Legend:			
Community Outreach			
Access to Care			
Social Justice			
Curriculum Integration			
Social EM Leadership			

All residents must participate in the following actvities at a minimum

QTY	Activity	PTS
1	CC Module	2
1	Curriculum Development	3
2	Community Outreach	1.5
1	Access to Care	1
1	Social Justice	1
1	JC Presentation	1
9	Track Meetings	2.25
		11.75
	Minimum Points	30

Figure 2. Point system for the 18-month longitudinal track. Note that opportunities in each pillar may vary over time. This figure lists opportunities from the fall of 2023.

regular medical care at locations commonly occupied by Miami's homeless population. Through a partnership with the Stop the Bleed Campaign, participants undergo formal training to serve as local instructors. Participants then lead workshops that teach non-medical community members to perform bystander cardiopulmonary resuscitation and stabilize victims of violence until first responders arrive. Participants may serve as instructors for Stop the Bleed events throughout MDC, as their schedules allow.

This pillar launched a Narcan program in July 2022, in partnership with the UM IDEA (Infectious Disease Elimination Act) Needle Exchange Clinic and the UM Michael Wolfson Department of Community Service (DOCS). This program seeks to address South Florida's opioid epidemic and is in keeping with the statewide Emergency Treatment for Suspected Opioid Overdose Act.[7] At community health fairs, participants provide free opioid use disorder (OUD) screening, based on Diagnostic and Statistical Manual of Mental Disorders, 5th ed, criteria.[8] Narcan is subsequently distributed to those identified to be at high risk for life-threatening overdoses, and additional OUD counseling and training on safely administering Narcan are provided.[9]

Access to Care

This pillar links chronically ill patients, high ED utilizers, and the uninsured to outpatient care. It also seeks to centralize existing social support resources within UM-JHS and efficiently address SDoH at the bedside. Through a partnership with DOCS, uninsured patients presenting to the ED with chronic complaints are paired with long-term patient navigators, who help them secure affordable outpatient care upon discharge.

The High Utilizers Initiative aims to streamline the care of patients who frequently visit the ED. Participants conduct chart reviews of individuals flagged as frequent utilizers in the electronic health record and create patient care briefs that auto-populate in their charts. These patients often present to the ED numerous times a week and receive care from different clinicians each time. By consolidating their pertinent medical information, these briefs allow for better, more streamlined patient care with less repetition of tests and procedures. The briefs also lessen the cognitive load of the clinician, decreasing the time spent on chart reviews and helping guide future care.

Many patients present to the ED with conditions that are exacerbated by a lack of basic resources. It is challenging to address these complex SDoH amidst the time constraints of ED care, and EDs can no longer rely heavily on social workers for assistance, due to the nationwide social worker shortage.[10] This pillar partnered with Miami Street Medicine and the JMH Pharmacy Department to create resource guides for patients and clinicians in response to this need. Community resource guides (in English, Spanish, and Haitian Creole) provide information for affordable outpatient clinics, prescriptions, mental health services, temporary housing, meal programs, and substance use treatment centers, as well as resources for pregnant patients and victims of domestic violence. Clinician resources include referral information for resident-run subspecialty clinics, instructions for initiating buprenorphine in the ED and referring patients to medication-assisted treatment clinics, and algorithms for human trafficking screening.

Social Justice

This pillar tackles health inequity and injustice issues through interdisciplinary education and quality improvement initiatives. The Human Trafficking Education Ambassador program, in partnership with JMH's Rape Treatment Center, teaches clinicians to screen for and treat victims of human trafficking. Florida has the third highest number of human trafficking cases in the nation, and MDC is, sadly, a known trafficking hub.[11] Trained residents lead interactive seminars, sharing HIPAA-compliant trafficking cases and teaching clinicians to identify and address red flags for trafficking.

This pillar also seeks to improve care for incarcerated patients in the ED, particularly concerning patient privacy and examinations in the presence of law enforcement. Initiatives include a recently published review on the barriers to caring for this population and recommendations to improve their delivery of care.[12] We also implemented a simulation session on caring for incarcerated patients into residency didactics.

IMPACT/EFFECTIVENESS

Curriculum Integration

Social EM leadership is in the process of completing a formal impact assessment of the curriculum integration pillar of the program via a single-group, pretest-posttest design.[6] Brief pre- and post-didactic session surveys are designed for each Social EM topic in the 18-month curriculum. Surveys are designed to assess baseline knowledge of the topic and the changes in this baseline knowledge after the session. Survey questions also address relevant epidemiological statistics and useful community resources for addressing the topic in MDC. Each post-survey ends with a blank section for participants to write in any additional feedback, which Social EM program leadership uses for subsequent didactic sessions.

For convenience, these surveys are administered via electronic forms; conference attendees scan QR codes to the forms before and after the session. All residents, faculty, students, and staff in attendance are eligible for participation in the surveys. However, thus far, survey participation has generally been limited to resident attendees, as faculty, staff, and student attendance is less consistent. Hospital badge

numbers are used to compare individuals' changes in pre- and post-session responses.

Since the 18-month curriculum was launched in 2022, a full rotation of the curriculum has not been completed as of this writing, and data collection and analysis is ongoing. However, thus far, the curriculum topics have been well-received, with residents indicating an improved confidence in their ability to recognize and address these Social EM issues at the bedside. For example, Figure 3 shows key results from the pre- and post-surveys administered during the first session of the formal curriculum in 2022—a simulation session on highly communicable diseases/sexually-transmitted infection (STI) epidemics (Table 1). These results suggest efficacy in improving baseline knowledge and confidence with the topic of acute HIV in the ED, including epidemiology, community resources, and initiating either highly active antiretroviral therapy or pre-exposure prophylaxis when indicated.

An impact assessment of the two-week elective is pending, as only one PGY-2 resident had completed at the time of this manuscript's development.

Community Outreach

It is challenging to concretely assess the impact of the Community Outreach pillar, as its service-driven initiatives are generally qualitative in nature. However, initial data from the Narcan Initiative highlights its impact on MDC. As of May 2023, the program screened 1,188 patients across MDC, of whom 144 received Narcan. In recognition of the Narcan Initiative's current impact and continued growth, JMH's Department of Emergency Medicine received the 2023 University of Miami Mitchell Wolfson Sr. Department of Community Service award.

Access to Care

We are currently in the early stages of data collection to analyze the success of the Access to Care initiatives. Thus far, the patient navigation program has enrolled 31 ED patients. Of these patients, 18 were able to successfully complete their navigation goals and obtain outpatient care. This program has particularly benefitted non-English-speaking patients, whose language barriers can hinder their ability to navigate a complex system. For example, navigators were able to link a Spanish-speaking patient to outpatient oncologic care for her untreated gynecologic cancer. Recently, a homeless, uninsured patient living at the Miami Rescue Mission (MRM) was treated for an acute ulcerative colitis flare in the ED. After he was discharged, the navigators ensured that he obtained timely follow-up at an MRM-affiliated gastroenterology clinic, a student-run clinic staffed by UM faculty. We are continuing to publicize this program and encourage emergency clinicians

N = 30 residents	Pre-Acute HIV Sim	Post-Acute HIV Sim
% Correct	43%	92%

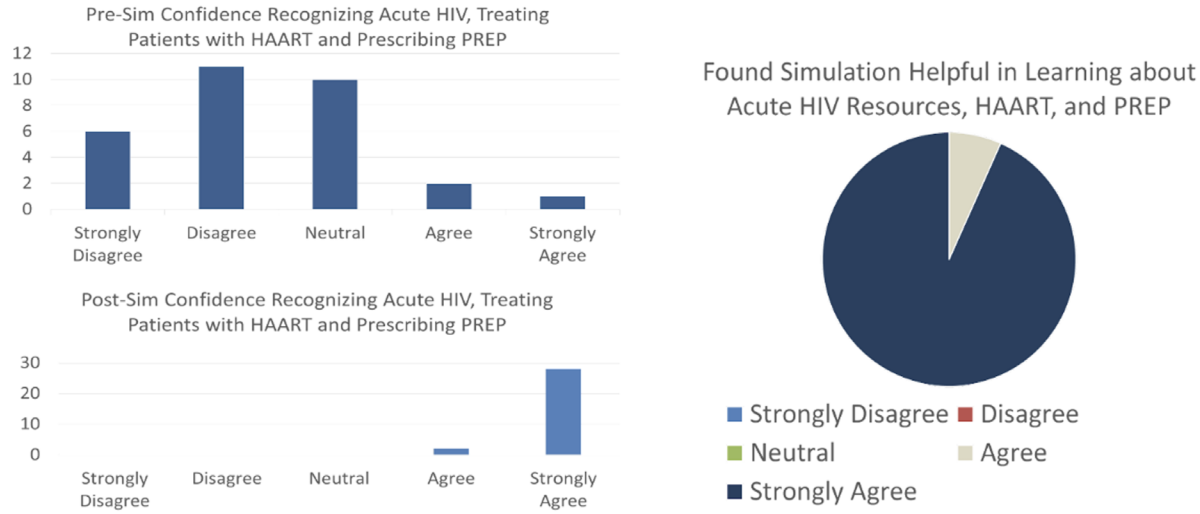

Figure 3. Comparison of key pre- and post-survey results after a simulation session on highly communicable diseases/STI epidemics; 30 residents completed the surveys. After the session, residents indicated an increased confidence in their ability to recognize acute HIV and initiate Highly Active Antiretroviral Therapy (HAART) or Pre-Exposure Prophylaxis (PrEP) treatment when indicated. Most residents found the session beneficial in learning about community resources for ED patients with HIV, as well as prescribing HAART and PrEP.

to enroll their patients during their shifts. We are still in the data collection phase of the High Utilizers initiative.

Social Justice

The Social Justice pillar initiatives experienced several launch delays due to COVID-19 pandemic restrictions and faculty turnover. Initiatives were officially launched in the 2022–2023 academic year, and data regarding their impact and effectiveness is pending. Thus far, human trafficking education ambassadors have given well-received lectures to JHS-affiliated clinics and to JMH's family medicine, pediatrics, and internal medicine residencies.

Overall Program Feedback and Support

Since the program is under the direct guidance of a current residency associate program director, there is continual communication between Social EM directors and EM residency leadership. Residency leadership actively engages with and provides insights into pillar initiatives, leading to timely changes to the program when deemed necessary. For example, previous feedback led to the development of the elective and longitudinal tracks. Residents in the core Social EM leadership team also obtain regular qualitative feedback from their peers and share this feedback with the Social EM directors. This program is also reviewed during the annual residency program evaluation committee meeting. This program has full EM departmental support.

Additional Recognition/Awards

Overall, this robust, multimodal, resident-led Social EM program has rapidly grown over the last three years, despite the COVID-19 pandemic. In 2023, six of the 14 PGY-3 residents graduated with a Social EM distinction. The program's interdisciplinary nature ensured its success, as multiple initiatives were launched without significant funding or administrative restrictions. The program is receiving increasing recognition. In addition to the previously mentioned community service award for the Narcan Initiative, the MDC chapter of the Stop the Bleed Campaign received a 2021 award from the mayor for its education initiatives in local high schools. In 2023, we were also honored to receive the 2023 ACEP Social EM Section Distinguished Program Award.

LIMITATIONS

Residents' availability often limits consistent participation in Social EM. Residents have multiple clinical and academic responsibilities, and as they progress through training, their time is further limited by searching for jobs and applying for fellowships. In response to this limitation, the elective and longitudinal track were developed to allow for flexible but regular participation, as many requirements can be completed during lighter rotations. The didactic curriculum also ensures that all residents will graduate with the same baseline knowledge of Social EM tenets. Additionally, the Social EM leadership will transition every two years, allowing junior residents with leadership roles to pass on their duties to incoming residents as they become senior residents.

Certain aspects of this program were designed to address some of the social issues that are particularly prevalent in MDC and may not be generalizable to other EM residency programs in the United States. Other residency programs seeking to develop their own Social EM initiatives should consider the unique needs of their patient populations when doing so.

The program's first three years were dedicated to overall development, garnering participants, finding community partners, and launching initiatives in each pillar. Therefore, data collection to formally assess the program's impact and effectiveness is still in process and is currently limited to initial data (unblinded pre- and post-tests completed by resident participants) from the launch of the 18-month didactic curriculum. This data may also be subject to selection bias, as most residents, faculty, students, and staff are excited about the Social EM program and want it to succeed.

CONCLUSION

The University of Miami-Jackson Health System Social EM program was launched in 2020 to address the SDoH of patients in Miami-Dade County—an area of significant medical and social need. It targets critical social issues through four pillars: Curriculum Integration; Community Outreach; Access to Care; and Social Justice. This multimodal, resident-run program achieved rapid success in three years by developing sustainable initiatives in partnership with local organizations and other UM-JHS departments. Rather than focusing solely on service opportunities, this program enhances residents' knowledge of SDoH, fosters the development of quality improvement initiatives, and provides opportunities to create meaningful change in the ED and the community. This program also provides residents with leadership and scholarly opportunities. We hope that this article will inspire other residencies to develop similar programs.

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Effectiveness of a Collaborative, Virtual Outreach Curriculum for 4th-Year EM-bound Students at a Medical School Affiliated with a Historically Black College and University

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Background: Diversity within the physician workforce is associated with improved clinical outcomes and patient satisfaction. Despite this, the US physician workforce, particularly in emergency medicine (EM), remains relatively homogeneous. Of all Black medical school students in the US, 14% attend the four Historically Black Colleges and Universities (HBCU) that have a medical school. Unfortunately, none of these schools are affiliated with an academic EM program. Because of this, there is less professional mentorship focused on obtaining a career in EM and potentially less formal curricula for senior medical students doing their home sub-internship in EM.

Objectives: Our objective was to fill the gap left by the absence of an academic EM department at Howard University College of Medicine (HUCOM) by creating a collaborative educational experience for fourth-year medical students during their home EM sub-internship. The curricular objectives were to teach core principles of EM, build relationships with students, and prepare them for pursuing EM residency training.

Curricular Design: Four EM academic departments collaborated to create and implement a virtual curriculum using the six-step approach to curricular development.

Impact/Effectiveness: After completion of the course, five students (100%) reported strongly agreeing with the following statements. These sessions 1) helped me learn the approach to core EM topics more than I would have been able to do on my own; 2) helped me learn key skills for excelling in an EM rotation more than I would have been able to do on my own; and 3) allowed me to connect with faculty and resident mentors to learn more about the field of EM. Of these five students, 80% and 20% reported strongly agreeing and agreeing, respectively, that these sessions helped them learn about the process of applying to and selecting an EM residency program. [West J Emerg Med. 2025;26(1.2)63–68.]

INTRODUCTION

Need for Innovation

Medical students interested in emergency medicine (EM) who attend a historically Black college or university (HBCU) do not have the teaching and mentorship that occurs when a medical school is affiliated with an academic EM program. We formed a collaborative program among four academic EM departments to help fill this need for EM-bound students at Howard University College of Medicine (HUCOM). To our knowledge, this is the first such program to be reported in the literature.

Background

A diverse physician workforce is associated with increased access to and utilization of the healthcare system, improved health outcomes and patient experience, and improved fiscal margins for hospitals.[1–4,4–6] Despite this, the medical field as a whole has made minimal advances in increasing physician diversity. In 2008 the percentage of Black or Hispanic US physicians from all specialties was 6.3% and 5.5%, respectively. By 2018, however, those percentages were only 5.0% and 5.8%, respectively. Even more concerning given the diverse patient population that the emergency department (ED) serves, EM remains among the medical specialties with the lowest number of physicians from backgrounds under-represented in medicine (URiM). Between 2008–2018, the percentage of emergency physicians who identified as Black decreased from 5.0% to 4.5%, and stayed constant at 5.3% for Hispanic/Latinos.[7]

When surveyed, 35% of EM program directors reported that the small number of URiM residency applicants was the greatest barrier to obtaining a diverse residency class.[8] Of all Black medical school students in the US, 14% attend four HBCUs with a medical school. Because none of these schools are affiliated with an academic EM program, their medical students have decreased exposure to EM in the pre-clinical years, less professional mentorship focused on obtaining a career in EM, and fewer formal curricula for senior medical students doing their home sub-internship (sub-I) in EM. This lack of mentorship has been identified as a critical barrier for URiM students across various specialties, contributing to lower application rates and residency placement. Studies suggest that mentorship increases both career satisfaction and inclusivity and the likelihood of these students entering and succeeding in competitive fields like EM.[9,10] In addition, a national survey of clerkship directors found that having a structured, standardized sub-I curriculum significantly improved the preparedness of students for residency, especially when these rotations were affiliated with residency programs.[11]

The Emory University Department of Emergency Medicine created a program with Morehouse School of Medicine to provide guidance to medical students interested in EM. A total of 115 Morehouse students completed an EM clerkship at Emory, and 62.6% successfully matched into EM.[12] While this program was successful, students typically rely on their home sub-I to prepare for mandatory away rotations. This absence of support from an academic department prior to away rotations may cause the students to find themselves less prepared and at a competitive disadvantage when they begin their away rotations. Furthermore, many EM residencies are not in proximity to a HBCU, requiring students to bear the financial burden of traveling to other cities and states for their away rotations.

At HUCOM, the EM sub-I relied heavily on an older, recorded online lecture series from an external institution, supplemented by bedside teaching from community attendings at one site, Howard Hospital. Students noted that the absence of formal educational components, such as weekly didactics, journal clubs, and simulation, resulted in limited exposure to "cutting-edge" EM practices. Moreover, the lack of interaction with academic attendings who are dedicated to medical student education, along with the absence of residents—who represent the next step in career progression—left students without access to critical mentorship and guidance. This gap hindered students' ability to visualize their own progression and receive practical advice from individuals at a similar stage in training, further limiting their connection to the broader EM community.

To help overcome that barrier, we created a collaboration between four academic EDs and HUCOM in an attempt to augment curricular offerings for EM-interested students on their HUCOM fourth-year EM home rotation. The collaboration between four academic EDs broadens the exposure students receive to different teaching styles, institutional cultures, and clinical perspectives. This variety provides a more comprehensive educational experience than what can be offered by a single institution alone.

Objective of Innovation

We aimed to address the absence of an academic ED at HUCOM by developing a collaborative educational experience. This program focuses on core principles of EM and residency preparation and was designed specifically for fourth-year medical students during their home EM sub-I at HUCOM. We obtained institutional board review approval from Wake Forest University School of Medicine.

Development Process

We used the six-step approach to curricular development. All final curricular design and content was agreed upon by the faculty representatives at each of the four participating residency sites.[13,14] 1) *Problem identification and general needs assessment.* Unlike traditional curriculum development where the need assessment is based on a specific health problem, our needs assessment was based on the need to increase the diversity of emergency clinicians by helping prepare under-represented students to succeed in away

rotations and the match. 2) *Determining and prioritizing content.* While individuals at each participating institution were involved with teaching at their own institution, the needs of the HUCOM students were unique. Therefore, educational objectives were developed in conjunction with the faculty advisor to the fourth-year EM rotation at HUCOM who conducted stakeholder interviews with five current medical students and five alumni who had recently graduated and were currently in EM residencies across the country. It was decided that curricular content would include a mix of core EM topics (as determined from stakeholder interviews) and advising sessions.

After all sessions, students were provided with the contact information for the faculty lecturers and were encouraged to reach out. 3) *Goals and objectives*. Broad curricular goals were developed. These were to a) teach the approach to core complaints in EM; b) teach key skills in EM; c) demystify the process of applying to an EM residency program; and d) connect students with residents and faculty in the field of EM. After this, specific measurable lecture goals were developed based on cognitive, affective, and psychomotor objectives for the learner. 4) *Educational strategies*. We created an entirely virtual, four-week didactic program, with content organized into weekly four-hour blocks, each led by a different academic ED, on an interactive platform that allowed for case-based discussions, small-group discussions, and standard lecture format. Since implementation in 2022, the program has been mandatory for all students completing their fourth-year EM sub-I at HUCOM.

Each week, the sessions required the participation of four to five faculty members who volunteered their time, with the majority of lectures delivered by a single faculty member. However, select sessions, such as the "Application and Interviewing Process," were co-led by a dynamic team consisting of the assistant program director, program director, and chief residents, providing a well-rounded perspective and valuable insights for the participants. Content was mapped and coordinated, and pre-reading was assigned from the Academy for Diversity and Inclusion in Emergency Medicine webinar series "How to Be a Successful EM Applicant" and the Clerkship Directors in Emergency Medicine/Society of Academic Emergecy Medicine M4 curriculum. Each day included a mix of clinical topics and "advising" sessions (Table 1). 5) *Implementation.* Approval from the EM director was obtained, and the curricula was implemented. 6) *Evaluation and feedback*. After each block of content, evaluations for each individual session (including the presenter) were sent to participating students via REDCap (Research Electronic Data Capture, hosted at Howard University School of Medicine.

These evaluations consisted of one question for each session: "Please rate the effectiveness of the following session in accomplishing its learning objectives: *Session, Presenter*." At the end of the month-long program, an overall evaluation of the program was sent to participating students, also via RedCap. The program evaluation survey tool, including four multiple-choice questions regarding the overall learning objectives, is reflected in Figure 1. The tool also included two free-response questions: 1) "Which parts of the curriculum were of most value to you?"; and 2) "Which parts of the curriculum could be improved?" We refined the curricula each year during an end-of-year debrief.

Implementation Phase

Prior to the first session, students were provided a spreadsheet with pre-session work, curriculum topics, presenting faculty and residents, dates and times, and links to access the weekly virtual sessions. Each EM program provided four hours of interactive didactics to the students according to the scheduled dates and times.

Outcomes

A post-curricular survey found universal agreement from students that the curriculum was effective in meeting the above goals. Of the five students, 100% reported strongly agreeing with the following statements. These sessions 1) helped me learn the approach to core EM topics more than I would have been able to do on my own; 2) helped me learn key skills for excelling in an EM rotation more than I would have been able to do on my own; and 3) allowed me to

Table 1. Curricula from sample block.

	Didactic session one Institution one	Didactic session two Institution two	Didactic session three Institution three	Didactic session four Institution four
Lecture topics	Personal statement	Presentation skills	How to choose the right program for you	Application and interviewing process
	Chest pain	Altered mental status	Toxicology overview	Headache
	Shortness of breath	Abdominal pain	Shock and sepsis	Gynecologic and urologic emergencies
	Radiographs	Electrocardiogram introduction	Vaginal bleeding	Endocrine and electrolytes
	Social emergency medicine	Ultrasound basics	Advanced trauma life support	Advanced cardiac life support, basic life support

Session:
Presenter:

Please rate the effectiveness of the following session in accomplishing its learning objectives on a scale from 1 (not effective) to 5 (very effective)

Questions	These sessions helped me learn the approach to core emergency medicine topics (abdominal pain, chest pain, headache, etc.) more so than I would have been able to do on my own.	These sessions helped me learn key skills for excelling in an emergency medicine rotation including oral presentations, EKG interpretation, x-ray interpretation and ultrasound, more so than I would have been able to do on my own.	These sessions helped me learn about the process of applying to and selecting an EM residency program.	These sessions allowed me to connect with faculty and resident mentors to learn more about the field of emergency medicine.
Response Options	Strongly agree, agree, neutral, disagree, strongly disagree	Strongly agree, agree, neutral, disagree, strongly disagree	Strongly agree, agree, neutral, disagree, strongly disagree	Strongly agree, agree, neutral, disagree, strongly disagree
Response				

Which parts of the curriculum were of most value to you?

Which parts of the curriculum could be improved?

Figure 1. Evaluation form sent to students after each session.

connect with faculty and resident mentors to learn more about the field of EM. Of the five students, 80% and 20% reported strongly agreeing and agreeing, respectively, that these sessions helped them learn about the process of applying to and selecting an EM residency program.

Narrative feedback, such as the quotes below, from students highlighted the value of meeting with faculty and residents from different programs. from going through cases in real time.

> Meeting the faculty and program directors at various EM programs really was the highlight of the curriculum. It was great to get an inside look at each program and learn more about their culture, approach, and the people there.

> I really enjoyed hearing the residents' perspective on how to navigate the application process.

Narrative feedback, such as the quotes below, also emphasized the value of the curriculum's interactive nature and how traditionally in-person topics were effectively adapted for virtual learning.

> My favorite part was participating in real-time cases. Being involved as the case unfolded felt like hands-on practice.

> It was incredible to have the mechanisms of ultrasound explained in such detail. Breaking it down to the basics really helped me understand ultrasound for the first time.

REFLECTIONS AND LESSONS LEARNED

Engagement of the Home Institution

Successful implementation required active engagement from HUCOM, specifically the clerkship director and administrative staff, who served as lead contacts. Control over rotation scheduling was essential to ensure all students were fully engaged in the sessions. In addition, as participating institutions used various online platforms to communicate and disseminate curricula materials, such as *Tintinalli's Emergency Medicine*, with their students, it was necessary to have HUCOM manage a central communications- and video-conferencing platform that was accessible to all lecturing institutions and participating students.

Engagement of Collaborating Institutions

Recruiting faculty and residents for each institution's week was challenging, but having representatives with strong connections in medical education made a significant difference. These relationships allowed them to quickly and effectively recruit lecturers, leveraging their networks to secure individuals who were both willing and enthusiastic to participate. This highlights the value of having institutional leads with established ties to their educational infrastructure, streamlining the recruitment process.

Collaborative Power

The success of this project involved a high degree of trust as many of the institutional representatives had not worked together. To develop this trust, we followed the framework of engaging, listening, framing, envisioning, and committing.[15] The power of this program is truly in the collective rather than the individual. While students could learn about atrial fibrillation from one institution, the real learning occurs when they see the collaboration, get a sense of the scope of EM as a professional field, and are able to interact with varied institutions that have different approaches to teaching and the practice of medicine.

Challenges with Small Student Cohorts

Unlike traditional EM rotations that attract students from across the country, our program had a small cohort comprised solely of HUCOM students, as there was no affiliated residency. This small group size meant that if one student missed a session due to interviews, illness, or other reasons, it noticeably impacted the learning environment, limiting group dynamics and peer-to-peer learning.

Program Limitations and Adaptations

Virtual learning posed challenges for teaching interactive skills such as ultrasound. We addressed this by incorporating case-based learning with curated image libraries and real-time feedback. To further enhance the learning experience, future iterations should explore the integration of ultrasound simulation software to better mimic hands-on scenarios.

Scalability and Expansion

Although initially designed for HUCOM students, this model could be expanded to other medical schools without academic EDs, especially those with a high proportion of URiM students. With the opening of additional HBCU medical schools, there is an even greater need for programs that increase access to EM education.

Limitations

Study limitations include the small sample size as well as lack of a comparison group. Future analyses will address these limitations and include evaluation of match outcomes as well as other learner-centered targets such as performance in Standardized Letters of Evaluation or subsequent rotations and intern year performance.

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