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Integrating Emergency Care with Population Health

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Western Journal of Emergency Medicine (*West*JEM): Integrating Emergency Care with Population Health (*West*JEM) is the premier open-access Medline-indexed EM journal in the world. As the official journal of California ACEP, American College of Osteopathic Emergency Physicians (ACOEP) and the California chapter of American Academy of Emergency Medicine (AAEM), the journal focuses on how emergency care affects health and health disparities in communities and populations. Additionally, *West*JEM focuses on how social conditions impact the composition of patients seeking care in emergency departments worldwide. *West*JEM is distributed electronically to 23,278 emergency medicine scholars and 4,323 in print. This includes 81 academic department of emergency medicine subscribers and 8 AAEM State Chapters.

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Getting Published in Medical Education: Overcoming Barriers to Scholarly Production

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INTRODUCTION

Medical education is experiencing rapid growth with an increasing number of publications and journals dedicated to education research.[1,2] Several new journals and special education issues (including the CDEM/CORD supplement by the *Western Journal of Emergency Medicine*) have arisen in recent years to address this increasing interest. As clinician educators, it is important to produce and disseminate research both for promotion and development of a subject niche, as well as to disseminate findings for others to learn from novel and successful educational interventions.

However, the quality of existing medical education research has been variable.[3,4] Studies have suggested this may be due to limited mentorship,[5] as well as challenges including available time, funding, small sample sizes, ability to navigate the institutional review board process, and difficulty with defining relevant and measurable outcomes.[6,7] This article discusses five common challenges to education scholarship and provides suggestions for overcoming them.

COMMON BARRIERS

1. Lack of Clarity in the Research Question

The first challenge is developing the research question. While this may seem like a relatively straightforward task, developing a *clear and important* research question evolves from an iterative process. This process generally begins with an educator's interest in a topic and a broad research question. For example, consider the case of a program director who is interested in identifying factors related to resident burnout. This is a broad topic because the "factors" are not clearly defined nor is the hypothesis clarified. Nonetheless, this is enough information to conduct a literature review to begin to understand prior work in the area, identify where there is a gap in knowledge, identify the novel research question, and to provide a link between the research idea and a conceptual framework.

The conceptual framework is a vital component to developing a good research question, yet it is often overlooked in medical education studies. A review of published medical education studies found that 55% did not mention a conceptual framework.[4] The conceptual framework serves as the foundation of the study that informs all aspects of the research design and should not be ignored. Frameworks relevant to medical education may be found in fields outside of medicine, especially education and psychology; so medical education scholars may want to extend their literature search outside of their medical specialty. In the example above, a thorough search of the literature would reveal that burnout studies are often framed within the context of the Multidimensional Theory of Burnout, a theory found primarily within the psychology literature.[8] Further discussion of conceptual frameworks and how they can be used to develop medical education research projects can be found in the classic paper by Bordage.[9]

After conducting a thorough literature review and identifying a specific problem to address, medical educational researchers can use two mnemonic tools to further develop their research question. The first is the PICOT framework, which is used to transform a broad question into a specific one that includes all of the necessary components: **P**opulation, **I**ntervention, **C**omparison, **O**utcomes, and **T**ime frame. One study demonstrated that research reports that used the PICOT format were rated as having better overall quality than those that did not.[10] Figure 1 includes an example of a structured question using the PICOT format (Figure 1).

The other valuable tool for designing a research question is the FINER criteria (Figure 2). As opposed to the PICOT framework, which helps to determine that all elements of a study question are present, the FINER criteria assess the quality and likelihood of success of a given research study. The authors recommend applying both sets of criteria to a given study question to ensure that the question is adequately refined, so as to maximize the success of each academic endeavor.

2. Inadequate Methodology to Assess the Study Question

Editors and reviewers desire to publish interpretations that are generalizable and accurate (i.e., supported by validity evidence). Despite recommendations that medical education research adhere to the same rigorous methodological standards as clinical research, medical education research often fails in this regard.[11] One study of submissions to a major medical education journal found that the top reasons for rejection included inappropriate statistics, over-interpretation of the results, an inadequate research instrument, an insufficient problem statement, inadequate literature review and an insufficient data, while a sound problem statement and study design significantly increased the likelihood of publication.[12]

Moreover, medical education research also fails to report substantial validity evidence, which presents a challenge to publication.[13,14] Many of these threats can be minimized by choosing an appropriate study design, standardizing study conditions, and collecting and reporting detailed information about study participants and procedures.

While the measurement instruments in clinical research are typically well validated (e.g., d-dimer, troponin), education research instruments are rarely as fortunate. Therefore, not only do education researchers need to define and collect meaningful outcomes for research, they also need to ensure the validity and reliability of their measurements. Many education studies focus on novel curricula, innovations, learner behaviors, or the exploration of education concepts or environments, for which previously established instruments are unavailable. If a new instrument needs to be created, or if using an instrument from another field (e.g., psychology, sociology, secondary education), the researcher is advised to first assess the validity of the instrument with respect to the intended measurement. In order to gather enough validity evidence to support the instrument, it is essential that the instrument be matched to the goals and objectives, piloted to ensure that it performs as expected, and compared to other similar measurements or available data.[15] The mere act of gathering validity evidence for an instrument or measurement (i.e., showing that it measures what it states it is going to measure and that it accurately distinguishes the target outcome from other outcomes) can be an important research study.

Novice education researchers faced with multiple competing demands may attempt to capitalize upon existing work by converting an ongoing education project into a research study. For example, an educator may develop a new curriculum and then subsequently decide to assess it after it has been ongoing for several months. Unfortunately, these research attempts are often unsuccessful due to insufficient planning and inadequate methodology and outcomes. To have a methodologically sound and successful study it is vital to define appropriate outcome measures at the onset and select an appropriate study design that best allows the researcher to measure the desired outcomes with minimal threats to validity. The researcher should collect validity evidence to create the assessment instrument during the developmental phase to ensure that the instrument is appropriate for the study. Involving a statistician or experienced education researcher early in the process is extremely beneficial to help avoid fatal flaws and wasted effort.

3. Losing Momentum

While manuscript publication should be one of the ultimate goals, it is important to set stepwise, attainable, intermediate milestones and celebrate their accomplishment

P: In emergency medicine residents,
I: is a 10-minute yoga session every week
C: in comparison with no intervention
O: associated with decreased levels of burnout
T: over the course of a year?

Figure 1. Example of a research question in PICOT formatting. *PICOT*, population, intervention, comparison, outcomes, time frame.

Feasible: Do you have enough time, money, expertise and number of subjects?
Interesting: Would others be interested in your results?
Novel: Does the study add to existing literature?
Ethical: Is the study ethical? Would it be approved by the IRB?
Relevant: Does it pass the "So what?" test. Will it make a difference in medical education?

Figure 2. FINER criteria for assessing study questions. *FINER*, feasible, interesting, novel, ethical, relevant; *IRB,* institutional review board.

on the route to manuscript completion and publication. Examples of early milestones in the scholarly process include abstract submission, initial paper development, and local and national presentations. There are also several digital mediums to publish medical education innovations. One example is the Academic Life in Emergency Medicine IDEA (Ideas in Didactics and Educational Activities) series (https://www.aliem.com/category/non-clinical/idea-series/), which allows authors to showcase novel education interventions to the broader medical education community. Additionally, educators may publish curricula online in MedEdPORTAL or the *Journal of Education & Teaching – Emergency Medicine*. Moreover, many institutions host "work in progress" sessions to highlight and discuss ongoing studies.

Ensuring early and attainable wins helps to maintain momentum for projects.[16] To be successful, researchers must actively plan and establish short-term goals and recognize the accomplishment of these goals and the specific team member contributions throughout the process.[16] Additionally, without a clear outline, unified writing plan, and identification of clear short-term goals, efforts can easily lose all momentum and dissolve into a disorganized, inactive to-do list without an end product. It is valuable to have regularly scheduled meetings or conference calls to ensure that all members are on track, especially for multi-institutional projects.

Education researchers should also consider maximizing the return on a given project by considering additional opportunities for expansion of a given project.[17] Often, it requires little additional effort to convert one project into several deliverables, such as an abstract, manuscript, presentation, and digital description of the innovation. Tables 1 and 2 provide a list of potential arenas for publication, as well as examples of different formats. For example, the start of a project might include the publication of a review article or

Table 1. Publication venues for medical education scholarship.

- Academic Emergency Medicine Education & Training (original contributions, brief contributions, new ideas in B-E-D-side teaching (educational case reports), education case conference, commentary and perspectives, book and media review, canvas/transitions)
- Academic Medicine (brief report, innovation, research report, perspective, letter to the editor, last page)
- Advances in Health Professions Education (original research, scoping reviews, systematic reviews)
- American Journal of Emergency Medicine (original research, reports, correspondence)
- Annals of Emergency Medicine (original and brief research, literature review, commentary)
- BMC Emergency Medicine (original research, technical advance article, debate)
- Canadian Journal of Emergency Medicine (original research, review articles, updates, editorials)
- Clinical Teacher (original articles, insights, letters to the editor, in brief, the clinical teacher's toolbox, faculty development reviews)
- Emergency Medicine Australasia (original articles, reviews, perspectives)
- Emergency Medicine Journal (original articles, short reports, reviews, best BETs, commentary, the view from here, swing shift: innovations in emergency medicine)
- European Journal of Emergency Medicine (research paper, short paper, opinion, editorial, rapid communication, review article)
- European Journal of Trauma and Emergency Surgery (original articles, reviews, letters to the editors)
- Internal and Emergency Medicine (debates, points of view, commentaries, review articles, original articles, case reports, the cutting edge: research update)
- Journal of Continuing Education in Health Professions (original research, reviews, innovations, forum, foundations, methodology, book reviews)
- Journal of Emergency Medicine (original research)
- Journal of Graduate Medical Education (brief reports, original research, ripout, innovation, review, on teaching and learning, perspective)
- Journal of the American Medical Association (original investigation, clinical trial, systematic reviews and meta-analysis, brief report)
- Medical Education (original research, review articles, cross-cutting edge, commentaries, letters)
- Medical Education Online (feature articles, research articles, trend articles, short communications, letters to the editor)
- Medical Science Educator (innovations, short communications, original research, monograph, commentary, letter to the editor, review)
- Medical Teacher (articles, short communications, letters to the editor, twelve tips, personal view, commentaries)
- Pediatric Emergency Care (original articles, illustrative cases, review articles)
- Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine (commentary, review, letter to the editor, original research)
- Teaching and Learning in Medicine (groundwork, validation, investigations, educational case reports, observations)
- Western Journal of Emergency Medicine (original research, brief research report, case report, editorials (invited), educational advances, systematic reviews, letters to the editor)

Table 2. Outlets for digital dissemination.

• Health Education Assets Library (HEAL): Digital library of multimedia teaching resources for the health sciences
• Journal of Education and Teaching in Emergency Medicine (JETem): Digital journal focused on medical education resources
• MedEdPORTAL: An open access educational resource for health care provider
• Multimedia Education Resource for Learning and Online Teaching (MERLOT II): Online repository and international consortium
• Portal of Geriatrics Online Education (POGOe): Elder care resource for interprofessional providers

perspective on that topic. This could also be converted into a didactic for residents or training session for faculty development. As the work progresses, you might consider a reflection or short thought piece. This approach can also help maintain momentum by assisting with the early wins described above. We would like to emphasize that researchers must be conscious to avoid self-plagiarizing or artificially separating out study components to create multiple publications from a study addressing a single concept (i.e., "salami slicing").[18]

4. Lack of Follow Through

Once the study is completed, it is important to go beyond the abstract with the goal of publishing it in a peer-reviewed journal. Historically, only 25-50% of abstracts presented at emergency medicine (EM) and medical education conferences are subsequently published as manuscripts.[19-24] Peer-reviewed publication is important because it increases dissemination of information and is a significant consideration in achieving promotion, tenure, and future grant funding.[25,26] This is particularly important for medical education research because of the relatively smaller proportion of outcomes-based studies in this field compared with clinical research.[3,4]

To make this process easier, the authors recommend that the researcher begin manuscript preparation at the start of protocol development, filling in components as the project progresses. Often, the introduction, research hypothesis, and methods can be drafted before the study begins, as part of the institutional review board proposal. This early planning will make the remainder of the paper more manageable when the study is completed.

When working as a team there may be more accountability to complete the paper; but team authorship can also create conflicts in author order. We therefore recommend discussing criteria for authorship, and drafting a potential order-of-authorship list, prior to beginning a study. Authors should also be aware that most publications are not accepted on the first submission, and often they may require submission to multiple journals.[27] Authors should not let a paper linger after the first rejection. Rather, they should read the review, make appropriate edits, and quickly re-submit to another journal. Authors should also be aware that different medical education journals have different foci, and publication will be more successful if they select journals that publish similar topics or types of articles in line with their particular manuscript.

It is not unusual for authors to hit a roadblock during the writing process. This can occur at any point throughout the process from beginning to end. It can be helpful to set specific goals prior to initiating the writing process. Each goal should have a specific deadline, which can help maintain momentum and accountability. Education researchers often have many competing demands; scheduling specific times on one's calendar for writing, similar to other appointments, can ensure dedicated time away from distractions for the author to concentrate on writing the manuscript.[28,29] In order to focus on the manuscript itself, authors should avoid checking emails and other distractions.[30] It may also be valuable to include small breaks when the author feels his or her attention waning.

Another tip is to start small. Rather than attempt to draft everything at one time, which may seem overwhelming, authors should start with either the first paragraph or the methods section (which are typically easier to write) and then expand from there. Use the standard framework for the manuscript, incorporating journal-specific components as needed. Since most articles follow a general layout, it is much easier to fill in the paper piece-by-piece using the layout as a recipe than attempting to create one's own format.[30] Write the first draft spontaneously and uncritically allowing for editing after the draft is written.[30] Attempting to edit while writing can interrupt concentration and flow. Finally, authors should have other people review their work whenever possible. This provides an external perspective and helps identify errors and confusing concepts that the investigators may have overlooked. It may be valuable to include non-physician researchers (e.g., PhD, EdD, PsychD) who can provide a highly valuable external interpretation, as many reviewers for medical education journals may not be physicians.

5. Lack of Expertise

For faculty who lack local experts with an education research background, getting started can be difficult. In these situations, it may be helpful to reach out to the clinical researchers within or outside of the department. Likewise, many academic systems have medical education researchers in other departments or in the school of medicine who may provide guidance. Another option is to join a project team from another institution. EM research is improved by multi-site collaboration, and working with a broader group may help develop skills.

There are formal options for research skill development. These include advanced degrees such as a Masters of Health Professions Education, institutional faculty development programs in education research, or the MERC (Medical Education Research Certificate) through the Association of American Medical Colleges. Often, the EM national meetings host workshops on research methodology. In addition, finding a virtual mentor in EM or another specialty might provide support for the educational scholarship one hopes to accomplish.

FUTURE DIRECTIONS

As medical education-focused researchers, we urge our specialty to consider future directions for creation and dissemination of our work. Just as we actively advocate for increased production, training and funding of EM clinical research, we must do the same for medical education research. First, we must start by growing the body of rigorously-conducted medical education trials published in high-quality journals. Second, we must take on the critical task of growing and promoting junior faculty who can expand our methodologic and content expertise. This step involves developing and promoting high-quality fellowships, which must include specific research training. We must encourage our mentees and colleagues to use state-of-the-art methods. This step may also consist of honest inquiry into continued barriers to methodologically-sound research studies.

Finally, to truly change the trajectory of medical education we must pursue outside funding. The sources of funding for medical education research are currently limited. As a specialty, we actively encourage government and foundation funding sources to dedicate resources to EM-relevant clinical questions. Similarly, building upon our existing contributions to medical education within and outside of EM, we must push for external groups to fund high-quality, multi-center studies of innovative educational methods. This direction should include the following: partnerships with researchers who are not primarily education focused; training of our colleagues in ways to bridge the funding divide; and possibly creation of novel funding sources (such as the Society for Academic Emergency Medicine's medical education research grants).

CONCLUSION

Medical education research continues to grow within EM and it is imperative that educators produce and disseminate high-quality publications to continue to advance this field. This article discusses several challenges and strategies for overcoming barriers to publication, in order to assist the educator with producing quality education research. It is the hope of the authors that this will encourage educators to publish more research to disseminate findings with the ultimate goal of further improving education and patient care.

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Jack of All Trades, Masters of One?

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"Ladies and gentlemen, this is your captain speaking. Actually I'm not a pilot; I'm an ER doctor. But in my lifetime I've been on over 200 flights, so I think I have a good idea of how the process works. I really love planes, and I've always thought it would be fun to fly one. In fact, one of my best friends is a pilot, and I've spent a lot of time in airports, and my grandfather was in the Air Force. So I think we should be just fine. Please sit back, enjoy the flight, and we'll see you in Atlanta."

No passenger in their right mind would stay on that plane. And hopefully no emergency physician in their right mind would ever say such a thing from the cockpit. And yet, we do much the same thing (albeit with less immediate risk) when we take on roles for which our only training is, essentially, that we really like planes and we've spent a lot of time in airports. Being emergency physicians prepares us for many things – but our skills may not translate directly into other realms.

In particular, our training and experience as clinicians may only partially prepare us to be educators. The era of "see one, do one, teach one" is as problematic when training education leaders as it is to training in clinical skills. Learning to teach emergency medicine simply by having been taught emergency medicine may not be enough. Without professional development aimed at understanding theoretical frameworks, rigorous assessment, evaluating educational programs, and formulation of answerable education research questions, the quality of the outcomes will be limited at best.

Emergency physicians are tasked with educational roles in every domain of our careers. We teach and learn from our patients, their families, our colleagues and our peers, in every realm in which we operate, whether clinical, administrative, or academic. Emergency physicians are nothing if not educators. Increasingly, though, emergency physicians are called upon as educational *leaders* and *scholars*, both within and beyond our specialty. Because emergency physicians are typically called upon to teach, lead, and discover, we must improve the quality of our educational efforts in each of these realms.

Training in education comes in many flavors. Faculty development programs have typically engaged clinician educators in ongoing skill development.[1,2] Many institutions have coalesced individual faculty development offerings into varying levels of certification.[3] Still, as roles for clinician educators have expanded to include active engagement in health professions education (HPE) innovation, dissemination and scholarship,[4] there is an increasing need for high-quality education research in HPE.[5] As HPE has become progressively more sophisticated, clinicians with education roles and aspirations have begun to seek opportunities for more advanced training. In response to this demand, the number of certificate and graduate-level programs in HPE has risen nearly exponentially. Where in the mid-1990s there were fewer than 10 masters degree programs in HPE, the number has now reached well over 100 programs worldwide.[6-8] The rise of online-only or asynchronous graduate degree programs has opened the doors to learners who live far from the institutions at which they study.

But why would EM clinician-educators – many of whom may already have substantial educational roles – pursue further formal training? Surely there is no requirement for masters-level or fellowship training for the emergency physician to assume scholarly or leadership roles in education. That said, evidence of educational faculty development is increasingly required of faculty worldwide. What advantages can formalized advanced training programs – fellowship programs, certificate training programs, or graduate degree programs – offer?

FOUNDATIONAL EDUCATIONAL KNOWLEDGE

The large majority of those who complete graduate programs or fellowships in medical education report that these programs had a strong influence on their educational skills and practices.[2,10,11] Understanding a structured, evidence-based approach to curriculum development lends itself to an improved educational "product," as well as increasing the

likelihood that educational innovation is disseminated as scholarship.[12] Most master's programs use applied learning approaches, which require learners to develop true-life examples of teaching practice, curriculum development, and assessment and evaluation schemes. Learning and applying what is learned in this manner lends itself to more fully-realized skill and understanding.

There exist a number of core domains within the scope of HPE training programs, including theories of teaching and learning, teaching practice (including educational methods and curriculum development), assessment and evaluation, research methods and scholarship, and leadership and management.[7] Within each of these core content areas lies the foundational knowledge and skills felt to be necessary for leaders in education scholarship and practice. The impact seems greater than simply providing the knowledge and technical skills, however. The literature identifies a number of additional potential benefits of advanced training in education beyond technical and theoretical expertise.

Medical faculty who seek formal training in HPE report that they are more prepared and more productive than their peers who follow more traditional routes, with improved professional educational activities and increased engagement in scholarly activities.[10] Master's degree graduates report even greater impact, including greater ability to institute curriculum reforms and improved assessment and feedback practices, but also greater engagement in scholarly activities and a higher rate of journal publication in education scholarship.[10] These skills in research will both advance the field as well as assist with promotion within academia.

FROM LEARNING COMMUNITY TO COMMUNITY OF PRACTICE

Beginning in the learning communities fostered within HPE programs – via relationships with faculty, mentors, and other learners – learners begin to form larger and more interconnected personal learning networks. These can be bolstered through social media, professional societies, and other endeavors.[13] As these learning networks become organized into formal communities of practice, they are often fruitful in developing ongoing professional partnerships within and beyond institutional boundaries.[14] Sharing common language and interests, learned through didactic work and network-building, promotes a connection to the broader community of educators, both within and beyond emergency medicine.

Mentorship

Perhaps the most important factor in academic productivity and success, the chance to establish and develop a mentorship relationship is among the drivers of satisfaction among graduates of advanced programs in HPE. Mentorship and collaboration build capacity for educational scholarship and research.[5,15] Serving as role models, coaches, and occasionally task-masters, mentors can model the type of lifelong learning necessary to maintain competence and retain passion. As each cohort of learners matures, the community of co-learners may also play a supportive peer-mentorship role; learners help one another set goals, review progress, and maintain enthusiasm for a variety of projects.[11] Having experienced the vitality of a successful mentoring relationship, program graduates are well positioned to begin to provide mentorship to more junior learners. Anecdotal and empirical evidence suggests that although formal mentorship roles are established for the duration of a course of study, these relationships often continue well beyond graduation.[16]

Professional Identity Formation

Emergency physicians (and physicians and professionals of all stripes) undergo a constant evolution of identity. This evolution is punctuated by a series of milestones, from the ceremonial white coat ceremonies in medical schools to graduations marking professional advancement and formal boundaries of entrustment. But this evolution in professional identity does not end with the completion of training. Many clinician-educators move through a series of intermingled overlapping stages, identifying with various roles (physician, teacher, administrator, researcher, and leader) to greater or lesser degree depending on the influences and interactions of professional life.

A firm identity as an educator need not require formal education training, but it is clear that this professional identification is stimulated when surrounded by like-minded colleagues, performing roles increasingly central to the educator's mission, and reinforced through shared experience, interests, and activities. As an educator's expertise develops so does the identity as an educator. A formal training environment, emphasizing scholarship and innovation, reinforces the developing professional identities of participants, moving from *something I do* ("I teach") to *someone I am* ("I am an educator"). Education leaders may be described as master adaptive learners, with focus on deep understanding of education theory, practice and improvement.[17] Often described as a transformative experience, advanced HPE training can solidify this sense of purpose and commitment as an educator.[11]

DEVELOPMENT OF AREAS OF FOCUS IN ACADEMIA AND CAREER ADVANCEMENT

While still possible to hold a position as an academic medical educator without formal qualifications, it is no longer sufficient, as Hu et al. report, "to remain the 'enthusiastic amateur.'"[18] Clinical or administrative expertise, once common criteria for appointment to educational leadership roles, no longer support this type of academic advancement. Particularly within medical schools, where non-clinician educators often have greater expertise

and longer records of education scholarship than do clinicians, the cachet that comes with formal training may pave the way for advancement of education leaders. In addition to laying the groundwork for a program of education scholarship, helping to build professional networks, and solidifying professional identity, formal training programs in HPE may provide the type of credential that a reputation as an enthusiastic teacher may not. Due to the advanced training and credentials associated with that training graduates may be called upon more often for consultation and expertise, in turn leading to greater responsibility. Though difficult to ascribe career advancement to formalized training alone, the exposure and recognition that result may certainly contribute to the likelihood of new opportunities.

Leadership Development

Simply by joining the community of practice of emergency medicine educators, broadening one's own personal learning network, and achieving expertise in the discipline of HPE, leadership opportunities will arise. Leadership skills – like many of the other skills that emergency physicians learn throughout our professional lives – can be observed, taught, and learned. Most advanced training programs in HPE contain a dedicated leadership component; leadership and management are included in the core content of most master's degree programs in HPE.[7] By focusing a significant portion of their curriculum on explicit understanding of leadership models, organizational structure, strategic management, and conflict resolution, these programs prepare graduates to be not just educators, but educational leaders. These leadership skills are broadly applicable, though inconsistently taught during clinical training. Leadership skills are valued by HPE training program participants and their employers, and have been reported to have significant impact on attitudes, knowledge, skills and behavior.[19]

CONCLUSION

Emergency physicians are well situated to move into leadership roles in education and education scholarship. As HPE has become increasingly professionalized, and the demands for rigor in education scholarship grow, emergency physicians are likely to continue to seek opportunities for formalized advanced training in education and education scholarship. As these advanced programs increase in number and scope, those clinicians who seek to further develop into leaders and clinician educators will likely increasingly be expected to attain such expertise.

Though the literature examining the impact of advanced programs in health professions education is in its infancy, early evidence suggests real value for their graduates. Graduates report gaining much more than technical teaching skills, though these are clearly crucial to building the foundation in education practice, leadership and scholarship. Participation in a program of advanced training helps shepherd the learner into the community of practice of medical educators, catalyzing connections in an ever-expanding network of collaborators and colleagues. Formal HPE programs can align learners with mentors whose guidance is crucial in developing skills and capacity as well as networking and career direction. Graduates of HPE programs report greater confidence and self-efficacy, as well as a more well-defined sense of professional identity. Formally-trained educators appreciate the effect that a "credential" has on career advancement, while recognizing that it takes more than a diploma to achieve success as a clinician educator; a well-developed personal learning network and community of practice are important for longevity.

Programs of faculty development in HPE are not without costs, both real financial costs and opportunity costs. Commitment to a longitudinal course of study in education may preclude learners from other opportunities, and protected time to fully engage in a learning program is a scarce commodity. Tuition for graduate degree programs may be costly, and if borne by the learner alone may or may not yield an acceptable return on investment. The decision to pursue HPE training, as well as which specific type of program to pursue (interleaved faculty development, post-graduate fellowship, certificate programs or degree-granting graduate program) is a choice best left to the learner. Factors including institutional support, protected time, location, mentorship, and other considerations are unique to each individual, and there is likely no universal "best fit." Working professionals must be able to find a balance of time committed to their program and time committed to their other personal and professional lives. Master's programs may require two to three years or longer to complete, and though criteria exist to ensure that programs adhere to the highest standards, this may be difficult to assess from the perspective of the prospective learner.[20,21] These are real considerations when embarking on such a program of study.

Though emergency physicians pride themselves on being able to do or teach nearly anything at any time, the pressures in academic practice often push faculty toward increasing specialization. From enhancing technical teaching skills to preparing working professionals to pursue careers as clinician educators, education leaders, and education scholars, advanced degree programs in health professions education may be appealing to emergency physicians who see themselves as embodying the full role of clinician-educators. More than being engaging teachers, leaders in education must understand the processes of curriculum design, must be able to teach skills in lifelong learning, must understand programs of assessment and evaluation, and must be able to transform this work into scholarship. Education leaders have the responsibility to do these things. With mastery of these skills, the clinician educator is now able to take a seat in the cockpit to safely guide the airline, aircraft, and passengers.

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Replacing Lectures with Small Groups: The Impact of Flipping the Residency Conference Day

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The flipped classroom, an educational alternative to the traditional lecture, has been widely adopted by educators at all levels of education and across many disciplines. In the flipped classroom, learners prepare in advance of the face-to-face meeting by learning content material on their own. Classroom time is reserved for application of the learned content to solving problems or discussing cases. Over the past year, we replaced most residency program lectures with small-group discussions using the flipped-classroom model, case-based learning, simulation and procedure labs. In the new model, residents prepared for conference by reviewing a patient case and studying suggested learning materials. Conference day was set aside for facilitated small-group discussions about the case.This is a cross-cohort study of emergency medicine residents who experienced the lecture-based curriculum to residents in the new flipped-classroom curriculum using paired comparisons (independent t-tests) on in-training exam scores while controlling for program year level. We also compared results of the evaluation of various program components. We observed no differences between cohorts on in-training examination scores. Small-group methods were rated the same across program years. Two program components in the new curriculum, an updated format of both adult and pediatric case conferences, were rated significantly higher on program quality. In preparation for didactics, residents in the new curriculum report spending more time on average with outside learning materials, including almost twice as much time reviewing textbooks. Residents found the new format of the case conferences to be of higher quality because of the inclusion of rapid-fire case discussions with targeted learning points. [West J Emerg Med. 2018;19(1)11–17.]

BACKGROUND

The lecture has long been the primary teaching method for graduate medical education.[1] Because lectures can be performed with large student-to-teacher ratios, they are considered an efficient teaching method.[1-2] Effectiveness of lectures as a teaching method has been called into question due to the lack of learner engagement.[2-3] Lectures put the responsibility for learning in the hands of the teacher, who regulates both the sequence and depth of content coverage. Learner participation is limited to listening, taking notes, and asking clarifying questions.

Educators have sought to replace lectures with methods that promote active learning and longer term retention.[4-7] One such alternative, the flipped classroom, has been widely adopted across a variety of disciplines.[7-10] The premise of the flipped classroom is that learners read and study new content independently in advance of a face-to-face classroom learning session.[11] Content is either prescribed by the instructor or independently identified by the learner and includes online learning modules, textbooks, or journal articles. Once learners are prepared, they meet with their peers in facilitated small groups to apply newly acquired knowledge to cases or problems. The flipped classroom is student-centered. Learning is driven by the learners but guided by experienced educators.[8,11]

Proponents of the flipped classroom hypothesize that it

allows adult learners to integrate new knowledge with existing knowledge.[9-10] The act of covering material at their own pace prior to a meeting promotes deeper learning, longer retention and life-long learning skills. The face-to-face classroom sessions promote knowledge application, critical thinking, and peer-faculty interactions. Additionally, flipped classrooms may prepare learners for eventual information-gathering and decision-making in complex clinical settings by mimicking real-life interprofessional interactions.[13-14]

Although studies of the flipped classroom are small and observational, there is growing consensus that students favor this method over the traditional lecture.[10, 15-19] In the flipped classroom, learners use study time to build a foundation for new learning instead of spending that time reviewing lecture notes and retrofitting new knowledge with old. The flipped-classroom method not only promotes longer term retention but provides learners with cues to the depth and breadth required for use of the new knowledge in clinical application. Challenges associated with the flipped-classroom model include increased time commitment for both educators and learners, effective integration of technology, ensuring individual learner accountability, and promotion of a safe learning environment.[10-11, 18,20]

The Accreditation Council for Graduate Medical Education (ACGME) requires that emergency medicine (EM) residency programs provide five hours of weekly didactic instruction.[21] Residents are required to participate in 70% of these didactics. Historically, our program has fulfilled ACGME didactic requirements through weekly lectures. For the 2015-16 academic year (AY 2016), we changed our didactic format to the flipped-classroom model.

OBJECTIVE

The purpose of this study was to evaluate the outcomes of our first year of flipped-classroom instruction through comparison to preceding years of lecture instruction.

CURRICULAR DESIGN

Instructional methods

During the 2015-16 academic year, we structured our residency conference around themes covering patient presentation (e.g., chest pain, pregnancy, shortness of breath). Lectures were replaced with facilitated small-group discussions using the flipped classroom and case-based learning. Simulations and procedure sessions were also added to the conference day. Residents prepared for conference by reviewing related patient cases, and then reading recommended learning materials. Residents were also encouraged to identify and read their own learning materials. Conference time was reserved for facilitated small-group discussions about the cases, and residents were given the opportunity to apply what they learned to diagnosing and developing management plans for patient cases.

Population

We performed a cross-sectional cohort study of EM residents who entered our program between 2011 and 2016. Our average enrollment grew over this time from n=12 per entering class to n=18. The E-2011 and E-2012 cohorts (n=28) were the last two cohorts to experience only the lecture-based curriculum. The E-2013 and E-2014 cohorts experienced both lecture-based and flipped-classroom curricula (n=31). The E-2015 and E-2016 cohorts experienced only the flipped-classroom curriculum (n=36). Our institutional review board declared this exempt research.

Measurements

We compared the performance of residents who participated in the flipped classroom to those who received the lecture curriculum on the annual American Board of Emergency Medicine (ABEM) in training examination (ITE), (a standardized test normed on all residents in ACGME-accredited EM residency programs). We controlled for training level by comparing resident scores by level separately (Figure 1).

We also developed a program evaluation questionnaire to assess resident opinions of their educational experiences. The questionnaire asked residents to rate each component of the program on both quality of instruction and value to their professional development. Residents were also asked how many hours they spent with textbooks, online instruction, and journals.

Data Analysis

While controlling for level of training (i.e., interns from the new curriculum were compared to interns in the old curriculum, etc.), we used independent t-tests to compare ITE scores for residents in the lecture-based curriculum to those in the new flipped-classroom curriculum (Figure 1).

We compared program evaluation survey results between residents who experienced the final year of the lecture curriculum (Academic Year 2014-15 [AY 2015]) to those who participated in the first year of the flipped-classroom curriculum (Academic Year 2015-16 [AY 2016]). This ensured that at least two thirds of the residents had experience with both curricula and were able to make fair comparisons. To avoid Type-1 error rates, a common problem when making multiple comparisons, we redefined the p-values considered statistically significant using the Bonferroni adjustment.[22]

IMPACT/EFFECTIVENESS

Table 1 shows the results of the cohort comparisons on ITE scores from independent t-tests. We observed no statistical difference on the average ITE scores between residents who participated in the lecture curriculum and those from the flipped-classroom curriculum at any of the three training levels (PGY1-3).

We received program evaluation surveys from 28 of 45 residents (62.2%) in AY 2015 and from 19 of 49 residents

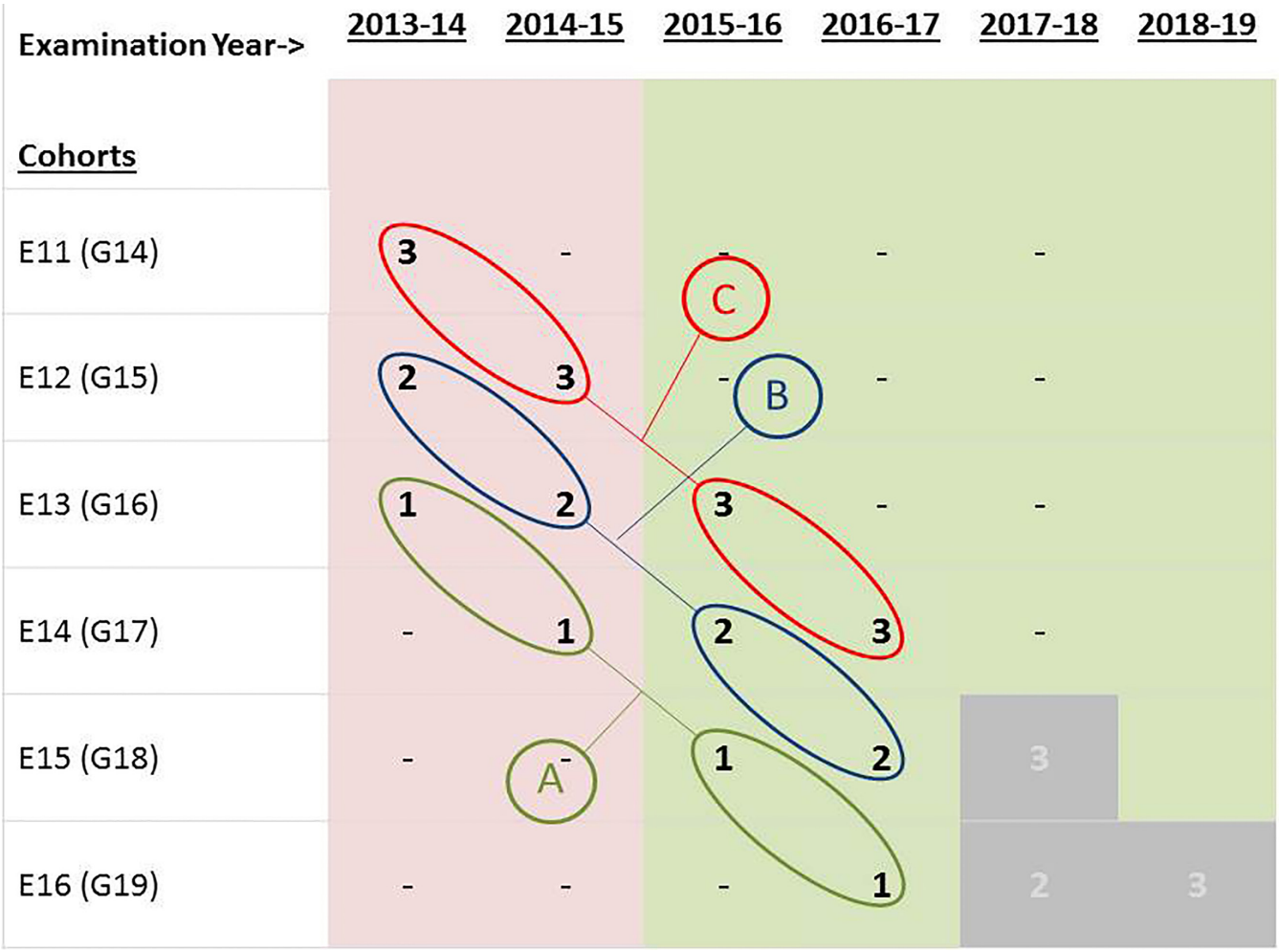

Figure 1. Comparison cohorts for in-training examination scores.

(38.8%) in academic year AY 2016. Twenty-seven residents were eligible to participate in both surveys; however, only nine of 27 residents (33.3%) completed both.

Program component ratings of quality and value are presented in Table 2. Program components used only in one year or the other are left blank to indicate that no statistical comparison was made. Almost all program components except for *Mock Oral Boards* were rated higher in terms of both quality and value by residents in the flipped classroom. However, only two components, *adult and pediatric case conferences,* were rated significantly higher in quality, but not value (adult case conference: t=-4.0,df=45,p≤.001,es=-1.19; pediatric case conference: t=-3.7,df=45,p=.001;es=-1.10). Cohen's d effect sizes (es) for these comparisons are considered large.[23]

Small-group methods were rated the same across program years. Although not significant, *lectures* were rated higher in quality and value in the flipped-classroom curriculum than they were in the lecture-based program.

Residents in the flipped-classroom curriculum reported spending significantly more hours with outside learning resources as a whole (textbooks, online learning resources, and journals combined) when compared to residents in the lecture-based curriculum (t=2.68; df=38; p=.011; es=-.852) (see Figure 2). The Cohen's d effect size (es) for the difference in average time spent with outside learning resources (all together) is considered large.[23] When compared separately, the amount of time spent on any one type of resource was not significantly different.

DISCUSSION

The adoption of a flipped-classroom educational model for our large academic medical center's EM residency program did not have any major impacts on traditional outcomes, such as standardized test results or program evaluations. Our findings are consistent with the published literature on use of the flipped-classroom model in health sciences education.[12,16,18]

Table 1. Comparisons of ABEM in-training examination scores by cohorts of residents who participated in the flipped-classroom educational model and those who did not at different levels of training.

Cohort ->	Comparison	E-2011	E-2012	E-2013	E-2014	E-2015	E-2016	t	df	p
Level at time of test		(N=12)	(N=14)	(N=15)	(N=16)	(N=18)	(N=18)			
PGY-1	A			70.5 (6.2)		71.3 (7.6)		0.16	65	.88
PGY-2	B		78.2 (6.0)		75.1 (6.5)			1.93	61	.06
PGY-3	C	81.0 (5.5)		78.1 (5.8)				1.78	48	.08

PGY, post-graduate year; *E*, entering year; *t*, independent test value; *df*, degrees of freedom; *p*, probability value.

- Comparison A: Compares first year in-training exam scores between those who experienced the flipped-classroom curriculum in year one of their residency and those who experienced a lecture-based curriculum.
- Comparison B: Compares second year in-training exam scores between those who experienced the flipped-classroom curriculum in year 2 of their residency and those who experienced a lecture-based curriculum in year 2 of their residency.
- Comparison C: Compares third year in-training exam scores between those who experience the flipped-classroom curriculum in year 3 of their residency and those who experience a lecture-based curriculum in year 3 of residency.

Residents in the flipped classroom reported spending significantly greater amounts of time with outside learning materials: textbooks, online learning resources, and journals. This is our most significant yet not surprising finding, since preparation for small-group discussion during class meetings is a program expectation. Residents in the flipped classroom reported spending almost double the amount of time with textbooks along with roughly 25% more time with online instruction materials and journals.

Increases in time spent with preparation materials may also explain residents' higher quality ratings of case conferences, both pediatric and adult. We believe that because residents come prepared to discuss and apply their learning to these cases that they find these activities to be of higher quality. Residents also expressed appreciation for the inclusion of rapid-fire case presentations during case conferences.

In our flipped-classroom program, the use of self-chosen learning resources was encouraged. We believe that this is appropriate at a graduate level of medical education, since preference for different types of learning resources are likely to be varied. The Free Open Access Medical Education (FOAM) movement has provided learners with a wealth of content material presented in a variety of ways from medical education experts around the world.[24] The fact that we did not see a large, significant increase in the amount of time our residents spent with online instructional resources, is probably attributable to the fact that our lecture-group residents had also used these materials to supplement their education.

Increased use of FOAM resources combined with a flipped-classroom approach to weekly didactic sessions is helping students at the post-graduate level to customize their education,[25] while reserving valuable group time for application of knowledge to real-world scenarios under the guidance of an expert.[26] We expected to see higher ratings of both value and quality of most of the program components under the flipped-classroom curriculum than the lecture curriculum. However, because so few of our respondents (9 of 27) experienced both program models, we are not sure that we captured a true "curriculum change" effect. In other words, residents rated what they know, without a reference to an alternative curriculum model.

Generally, our program evaluation provided some evidence for a successful transition from a lecture-based to a flipped-classroom residency curriculum. The educational outcomes we were able to measure through standardized tests and program evaluations remained stable across the two programs. While learners in our program seemingly have responded to the flipped classroom by adopting the required preliminary learning, we are unable to confirm that the flipped-classroom model is truly superior to traditional lecture methods with regards to educational efficacy.

LIMITATIONS

Our efforts suffer a few limitations, the worst of which was incomplete program evaluation data from our residents, particularly in the second year of the study. While we reached nearly a 40% return rate from residents in that academic year, the probability of selection bias was high. We checked for selection bias and recognize that our respondents represented more PGY-1 and 3 residents.

While the ABEM ITE assesses the collective medical knowledge of resident trainees, this single, annual assessment of medical knowledge may not be sufficiently sensitive to detect the subtle differences in educational achievement obtained from two different curriculum models. While the flipped-classroom method of teaching is designed for deeper learning and longer-term retention, an annual standardized test may not be the best measure of this type of learning.

Future studies using assessment instruments more specifically designed for measuring educational efficacy between the flipped classroom and traditional lecture methods are needed. Furthermore, study designs that are effective at

Table 2. Evaluation of program components by 28 of 45 (62.2%) residents from academic year 2015 (lecture curriculum) and 19 of 49 (38.8%) residents from academic year 2016 (flipped-classroom curriculum). Response options for quality were 1=Poor, 2=Marginal, 3=Satisfactory, 4=Good, and 5=Excellent. Response options for value were 0=No value, 1=Minimal value, 2=Moderate value, 3=Considerable value, and 4=Great value.

	AY 2015		AY 2016					
	Mean	SD	Mean	SD	t	df	p*	es†
Lecture: including grand rounds								
Value	3.11	.92	3.68	.89	-2.15	39.7	.037	NA
Quality	3.25	1.01	4.00	.75	-2.77	45	.008	NA
Small group								
Value	3.61	.79	3.84	.83	-0.98	37.2	.332	NA
Quality	3.56	.93	3.68	.82	-0.48	44	.631	NA
Journal club								
Value	2.68	.95						
Quality	2.38	1.06						
Procedures lab								
Value			3.95	.85				
Quality			3.63	.90				
Adult simulations								
Value			3.74	.73				
Quality			3.68	.90				
Pediatric simulation								
Value			4.11	.57				
Quality			3.89	.81				
Evidence-based medicine								
Value			2.53	.61				
Quality			2.95	.91				
Trauma M&M								
Value	3.46	.88	3.74	.81	-1.08	45	.287	NA
Quality	3.43	.92	4.05	.78	-2.42	45	.020	NA
ED M&M								
Value	3.89	.96	3.58	1.07	1.05	45	.298	NA
Quality	3.71	.90	3.95	.78	-0.92	45	.362	NA
Adult case conference								
Value	3.46	.92	4.11	.74	-2.53	45	.015	NA
Quality	3.36	.83	4.26	.65	-4.00	45	.000	-1.19
Peds case conference								
Value	3.41	.89	4.05	.780	-2.55	44	.014	NA
Quality	3.29	.85	4.16	.688	-3.70	45	.001	-1.10

AY, academic year; *SD,* standard deviation; *t*, independent test value; *df*, degrees of freedom; *p*, probability value; *es*, effect size; *M&M,* morbidity and mortality conference .

*Adjusted p-value for significance = .05/10 or .005

†Cohen's D effect sizes are generally interpreted as follows: .2 = small effect, .5= medium effect, and .8=large effect.

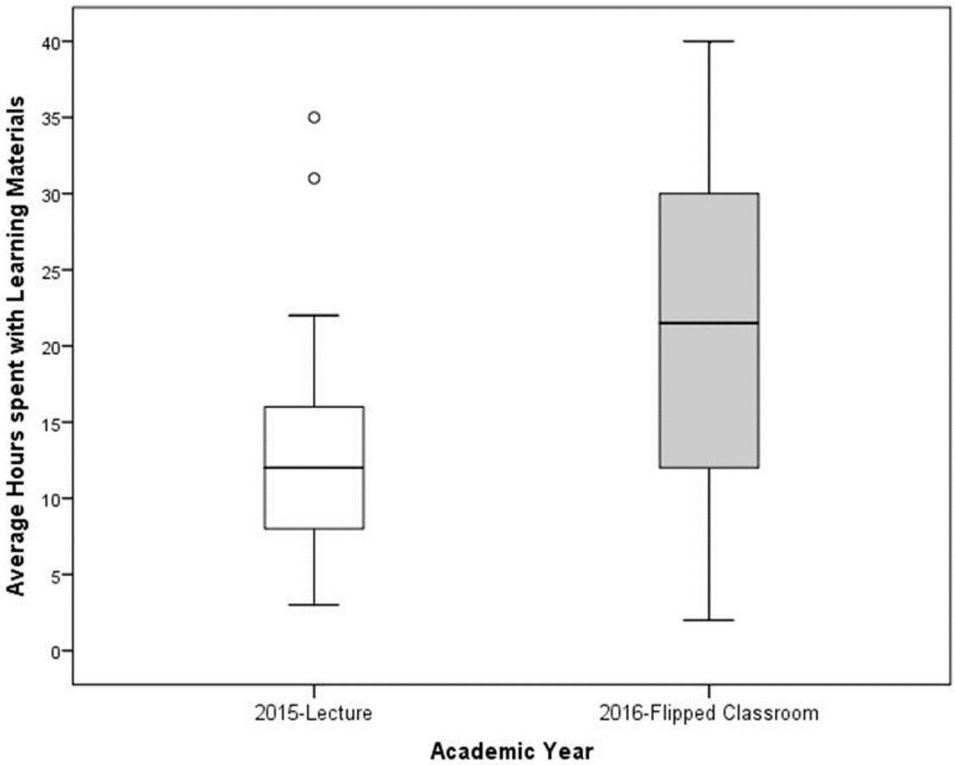

Figure 2. Box and whisker plot comparing average hours spent with outside learning materials such as textbooks, online learning resources and journals across two groups of residents: one from a lecture-based curriculum year (2015) and one from a flipped-classroom curriculum (2016).

Table 3. Estimates of time spent with learning materials from 22 residents in academic year 2015 (lecture-based curriculum) and 18 residents from academic year 2016 (flipped-classroom curriculum).

	AY 2015		AY 2016					
Time with learning materials (in hrs)	Mean	SD	Mean	SD	t	df	p*	es†
Textbooks	4.18	2.63	7.56	6.09	-2.19	22.2	.039	NA
Online instruction	7.40	6.52	9.94	6.28	-1.22	36	.230	NA
Journals	3.00	2.47	4.33	3.71	-1.34	37	.189	NA
Total time	13.77	7.96	21.83	11.04	-2.68	38	.011	-.852

AY, academic year, *SD,* standard deviation; *t*, independent test value; *df*, degrees of freedom; *p*, probability value; *es*, effect size.
*Adjusted p-value for significance = .05/4 or .0125
†Cohen's D effect sizes are generally interpreted as follows: .2 = small effect, .5 = medium effect, and .8 = large effect.

isolating the type of learning that occurs in classroom didactics from the type of learning that takes place in the clinical environment could contribute to further understanding the efficacy of different curriculum methods.

CONCLUSION

In the flipped-classroom program, residents spent more time with learning resources outside of the classroom. We see this as an indicator that they were investing more time with self-directed learning. The flipped-classroom program had no detectable effect on ITE scores and minimal effect on residents' ratings of program components. Our findings are somewhat consistent with the findings of others. In summary, we believe that the flipped-classroom model is as educationally effective as traditional lecture methods and holds promise for further exploration. Additional studies with more sensitive assessment instruments are needed to identify potential differences in educational efficacy between the flipped classroom and traditional lecture methods.

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Tracking Student Mistreatment Data to Improve the Emergency Medicine Clerkship Learning Environment

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Introduction: Medical student mistreatment is a prevalent and significant challenge for medical schools across the country, associated with negative emotional and professional consequences for students. The Association of American Medical Colleges and Liaison Committee on Medical Education have increasingly emphasized the issue of mistreatment in recent years, and medical schools are tasked with creating a positive learning climate.

Methods: The authors describe the efforts of an emergency department (ED) to improve its clerkship learning environment, using a multifaceted approach for collecting mistreatment data and relaying them to educators and clerkship leadership. Data are gathered through end-of-rotation evaluations, teaching evaluations, and an online reporting system available to medical students. Mistreatment data are then relayed to the ED during semi-annual meetings between clerkship leadership and medical school assistant deans, and through annual mistreatment reports provided to department chairs.

Results: Over a two-year period, students submitted a total of 56 narrative comments related to mistreatment or unprofessional behavior during their emergency medicine (EM) clerkship. Of these comments, 12 were submitted in 2015-16 and 44 were submitted in 2016-17. The most frequently observed themes were students feeling ignored or marginalized by faculty (14 comments); students being prevented from speaking or working with patients and/or attending faculty (11 comments); and students being treated in an unprofessional manner by staff (other than faculty, 8 comments).

Conclusion: This article details an ED's efforts to improve its EM clerkship learning environment by tracking mistreatment data and intentionally communicating the results to educators and clerkship leadership. Continued mistreatment data collection and faculty development will be necessary for these efforts to have a measurable effect on the learning environment. [West J Emerg Med. 2018;19(1)18–22.]

BACKGROUND

Medical student mistreatment is increasingly emphasized as an issue of concern in medical schools across the country. Numerous studies have examined mistreatment and its effects on medical students and have demonstrated harmful associations ranging from increased burnout[1] to symptoms of post-traumatic stress.[2] Mistreatment has been tracked in the Association of American Medical Colleges (AAMC) Medical School Graduation Questionnaire (GQ) since 1991, and the high incidence of reports has led to a national dialogue about

the issue, with increased efforts to define, measure, and prevent mistreatment.[3] Mistreatment, as defined by the AAMC GQ, can take many forms, including discrimination based on gender, race and ethnicity, or sexual orientation, public humiliation, physical harm or threatened physical harm, requests to run personal errands, or sexual harassment.[4] In a 2011 survey of third-year medical students from 24 different medical schools, 64% and 76% of respondents experienced at least one incident of mistreatment by faculty and residents, respectively.[1]

To maintain accreditation, medical schools are required to meet Liaison Committee for Medical Education (LCME) standards, which now focus on a school's learning environment, level of professionalism, and prevention of mistreatment.[5] Medical schools have reported various interventions to address mistreatment, involving anonymous student surveys, reporting systems, and standardized protocols for intervention,[6-8] as well as initiatives that allow students to evaluate the learning environment, more broadly.[9] Despite increased awareness, medical student mistreatment remains prevalent throughout medical programs.[1,10]

OBJECTIVES

In light of the continued frequency of mistreatment in medical education, our emergency department has undertaken initiatives to address mistreatment that may be occurring within the department. Our objective was to analyze two years of required emergency medicine clerkship (EM) clerkship data, from multiple sources, to identify areas in which the learning environment could be improved. We then describe how mistreatment data is used in a multifaceted approach to address concerns of mistreatment, which involves tracking student comments, analyzing common themes, and communicating data directly to medical educators and clerkship leadership.

CURRICULAR DESIGN

As part of the multifaceted approach to mistreatment, each department was provided with four sources of mistreatment data. First, it received the answers to three questions related to the learning environment that are on end-of-rotation evaluations completed by medical students. Second, one question, with accompanying narrative comments about unprofessional behavior, was completed by medical students for faculty and resident teaching evaluations. Third, a member of the medical school evaluation team reviewed the narrative comments for each faculty and resident, and collected any comments suggesting unprofessional behavior toward students. Specifically, comments about frank mistreatment or disrespect were selected to ensure that the clerkship leadership and department were addressing problematic faculty behavior.

For the purpose of this paper, a team member read each comment and constructed a content coding scheme. This scheme was then used to code comments for content analysis. Themes were identified based on the source of the mistreatment (faculty or staff), the target of the behavior (students or other individuals), and character of the mistreatment. Two other members of he team then reviewed the coded comments, with no discrepancies identified. Cases where more than one student submitted comments on the same faculty member were considered to be unique cases/comments for the purposes of content analysis. Finally, medical students used an online reporting system, whereby reports requiring further investigation were sent directly to the senior associate dean. Students could submit formal mistreatment reports as either identified or anonymous, and could choose whether a report was to be immediately reviewed or embargoed until a later date.

All of these data were then relayed to the various departments via two different methods. During semi-annual meetings between clerkship leadership and the medical school assistant deans, clerkship evaluations were reviewed and plans were put forth to address student concerns, including those related to the learning environment and mistreatment. Additionally, the associate dean's office provided annual mistreatment reports to the chairs of each department. In 2017, there was an expectation that each department would respond to the annual report with an action plan to improve the learning environment. The medical school's process for addressing mistreatment was deemed exempt by the institutional review board.

IMPACT/EFFECTIVENESS

Mistreatment Data

Table 1 summarizes mistreatment data from 2015-16 and 2016-17 end-of-rotation evaluations for the EM clerkship and the range in results from other required clerkships. In response to the question, "Students are treated in a professional/respectful manner in this clerkship," EM was on the low end of the range compared to other clerkships. Similarly, in response to the question, "Students are treated in a professional/respectful manner by faculty," EM also scored low.

In 2015-16 and 2016-17, respectively, 100% and 99% of students on the EM clerkship reported that they were treated in a professional/respectful manner by faculty. These results are similar to the range in percentages reported in other clerkships for this question. Finally, 4.8% and 1.7% of students reported in 2015-16 and 2016-17, respectively, that faculty ever behaved in an unprofessional or disrespectful manner in this clerkship. These results are on the lower end of the range observed in other clerkships.

Students submitted 56 narrative comments related to mistreatment or unprofessional behavior in the EM clerkship, with 12 comments submitted in 2015-16 and 44 comments submitted in 2016-17. These comments were split into

Table 1. Student responses to end-of-rotation learning environment and mistreatment survey questions.

Survey question	EM* 2015- 16 (N=149)	Other clerkships 2015-16 (N=129-171)	EM 2016- 17 (N=98)	Other clerkships 2016-17 (N=151-306)
"Students are treated in a professional/respectful manner by faculty." (Mean of 4-point scale from "Strongly Disagree" to "Strongly Agree")	3.55	3.55-3.82	3.49	3.61-3.83
"Students are treated in a professional/respectful manner by faculty." (Percent of students responding "Agree" or "Strongly Agree")	100%	97-100%	99%	98-100%
"Overall, I was treated in a professional / respectful manner in this clerkship." (Mean of 5-point scale from "Strongly Disagree" to "Strongly Agree")	4.59	4.45-4.79	4.52	4.52-4.81
"How often did this [attending/ instructor/ preceptor] behave in an unprofessional or disrespectful manner?" (Percent of faculty with response other than "Never")	4.8%	2.7-11.1%	1.7%	0.8-9.0%

EM, emergency medicine.

broad theme categories, with nine total theme categories identified. Table 2 summarizes the results from these narrative comments, with representative quotes provided for each theme. The most frequently observed themes were the following: students feeling ignored or marginalized by faculty (14 comments); students being prevented from speaking or working with patients and/or attending faculty (11 comments); and students being treated in an unprofessional manner by staff (other than faculty, eight comments).

For the 44 comments submitted in 2016-17, 28 of these comments were uniquely associated with 15 faculty members and three residents, and the remaining 16 comments were submitted generically as part of the overall evaluation of the EM clerkship. For the 12 comments submitted in 2015-16, five submitted comments were associated uniquely with four faculty members, and seven of these comments were submitted generically as part of the overall evaluation of the EM clerkship. There were similar numbers of residents (57) and faculty (120-124) evaluated for each year respectively. Based on the narrative comments, mistreatment or unprofessional behavior occurred in 13% of faculty (15/120 faculty) in 2016-17 and 3% of faculty (4/124 faculty) in 2015-16.

Overall, students responded that respect by faculty and residents was lower when compared to most clerkships. However, on the individual faculty/resident evaluations, almost none were noted to be disrespectful. This discordance may be due to the majority of disrespect coming from staff rather than faculty or residents, or an overall attitude that was not attributable to a person. A study of the types of mistreatment attributed to non-faculty staff would be valuable, as our data did not capture these specifics. It is also possible that students are not completing specific evaluations on evaluators who were disrespectful, or that the disrespect is coming from a small number of evaluators. Furthermore, the majority of EM students indicated that they were treated in a respectful manner by faculty overall, raising the question of how much individual instances of mistreatment impact overall student perceptions of learning environment. Regardless, it is the responsibility of the clerkship to address mistreatment and optimize the learning environment.

Additionally, three formal mistreatment reports have been filed against the ED to the Dean's office in the past two years. One report was about a consultant who was felt to have "screamed" at the student, another was about an administrator who was reportedly rude and chastising to the student, and the third report, as detailed by a third-person observer, was about an EM resident providing inappropriate (offensive, sexist, unprofessional) feedback to a female student.

Although identifying common themes in medical school mistreatment is a valuable first step, communication and action are required from clerkship leadership in order to have a positive impact on the learning environment. The two years of mistreatment data described above are consistent with national reports of medical student mistreatment,[3] while also providing insight into the particulars of mistreatment at our institution. Though challenging, we seek to achieve improvement of the learning environment through a multifaceted approach described below where key stakeholders provide and receive periodic feedback.

Steps to Address Mistreatment Concerns

First, prevalent themes regarding mistreatment are discussed yearly at faculty meetings and resident conferences. These discussions include how to interact with and effectively

Table 2. Summary of content of student comments.

Theme	Number of comments (% of Total)	Representative quotes
Students ignored or marginalized by faculty	14 (25.0%)	"She made me feel like a burden. When she disagreed with my plan, she would correct me in disinterested manner without explaining her reasoning or where I went wrong. It took multiple follow up questions to her (which she seemed annoyed to answer) before I got to the underlying learning point. Overall, I felt unwelcome and I left the 8 hour shift with very little new knowledge, as the learning environment was so poor and she was such a weak teacher."
Students prevented from speaking or working with attending and/or patients	11 (19.6%)	"When I worked with Dr. X teaching was not emphasized so that patients could be processed more quickly. He also did not want me interacting with the attending so that we could process patients faster. There was also little discussion of plans that I presented, just a statement of what his plan was after I discussed patients with him with little feedback from him."
Staff unprofessional behavior towards students	8 (14.3%)	"Nursing staff was occasionally disrespectful and undermined my attempts to interview patients. Nursing staff would not want to involve students in patient care because it takes longer to communicate results to the student versus the attending or resident, and I felt kept in the dark in some issues of patient care and was the last to know some important piece of information several times." "I also had many techs and nurses say inappropriate things to me. I'm not sure if it is just the 'EM culture' but I have never experienced this amount of just rude behavior from staff...Also, just the amount of sex jokes and demeaning women jokes was kind of appalling. I have never, in the past four years, felt uncomfortable and embarrassed to be a woman in medicine until this rotation."
Faculty hostile or unprofessional behavior towards students	6 (10.7%)	"Just scut work with some residents." "She did not dismiss me until 2 hours after my shift ended although I had told her my shift time early on."
Students treated as stupid or discouraged from asking questions	5 (8.9%)	"Remember that we are students and we are new at emergency medicine and we are all trying to learn. It is discouraging when our suggestions are met with derision."
Other–unprofessional behavior	5 (8.9%)	"There were a lot of times I couldn't tell if she was displeased with me, or just busy and stressed. If I did a bad job on some things I wish she just would have told me."
Faculty unprofessional behavior towards others (patients or staff)	4 (7.1%)	"On several occasions I heard attendings make comments about patients or other coworkers that I felt were in poor form or poor taste. An example: 'That patient is a miserable human being. Let's get them out of here.'"
Faculty unprofessional comments about student evaluations	3 (5.4%)	"Had one episode where he expressed, in a rather crude manner, his nonexcitement at having to fill out a student evaluation (i.e. the yellow card)."

teach students. Student comments that describe a suboptimal learning environment because they are ignored, for example, are addressed through discussions focused on how to engage students during a busy shift. Resident evaluations by students are also reviewed with resident leadership during semi-annual resident reviews.

Individual evaluations are sent annually to faculty and reviewed with departmental leadership during their annual review. One-on-one meetings are scheduled for individuals with recurring problems. If these issues continue, faculty meet with the associate chair for education, and if still unresolved, with the chair. All student comments are reviewed during residents' semi-annual review with the program director.

Students at our medical school may rotate at one of four sites to complete their required rotation – a university hospital, a suburban community hospital, and two urban safety-net hospitals – with the majority of students rotating at the university hospital. Faculty at two of these sites are associated with our medical school faculty, while the others are not.

Mistreatment at non-affiliated sites is sometimes challenging to address, as these faculty may have less experience working with medical students, and are not beholden to the LCME standards of our institution. Each site does have a faculty lead, and meetings are held yearly and rotational evaluations are reviewed. Additionally, feedback is shared with individual faculty and with their departmental lead.

Faculty and resident development is another key to improve the learning environment. Faculty are encouraged to participate in order to improve teaching skills, provide effective feedback, and learn to balance the demands of teaching with clinical care during busy shifts.

Finally, medical student comments about mistreatment involve not only faculty and residents, but also nurses and hospital staff. For this reason, clerkship leadership meets with nursing leadership on a yearly basis to review all nursing feedback and comments. When appropriate, nursing leadership has also brought issues to their larger-scale nursing meetings.

LIMITATIONS

Our analysis of medical student mistreatment includes two years' worth of data, which may be insufficient to establish a meaningful trend. Continued tracking will be necessary to determine the effects of reporting and remediation on reducing incidents of mistreatment, especially as there may be a trend toward more concerns about the learning environment for 2016-17.

In our model, feedback to educators and leadership occurs annually or semiannually. The goal of this is to allow for sufficient time to address unprofessional behavior and determine if changes have been implemented based on collected data. However, the feedback intervals to faculty may be too infrequent to effect timely changes, and each institution may wish to weigh these factors carefully.

Anonymous data collection precluded examination of whether complaints were clustered around particular shifts, certain students, or if there were significant data outliers. Moreover, the reports by students may be influenced by a variety of factors such as stress level, perceived clerkship performance, or formal and informal evaluations from faculty and residents. It is important to recognize that, given the sensitive nature of mistreatment, there is likely an under-reporting of behaviors even with the confidential reporting system.

CONCLUSION

We have described themes from two years of mistreatment data for an EM clerkship, and how mistreatment data are channeled to provide feedback to educators and leadership in an effort to improve the learning environment. We intend to track future mistreatment data to see what effects, if any, these interventions have on rates of mistreatment.

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The Flipped Journal Club

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Introduction: Educators struggle to develop a journal club format that promotes active participation from all levels of trainees. The explosion of social media compels residencies to incorporate the evaluation and application of these resources into evidence-based practice. We sought to design an innovative "flipped journal club" to achieve greater effectiveness in meeting goals and objectives among residents and faculty.

Methods: Each journal club is focused on a specific clinical question based on a landmark article, a background article, and a podcast or blog post. With the "flipped" model, residents are assigned to prepare an in-depth discussion of one of these works based on their level of training. At journal club, trainees break into small groups and discuss their assigned readings with faculty facilitation. Following the small-group discussions, all participants convene to summarize key points. In redesigning our journal club, we sought to achieve specific educational outcomes, and improve participant engagement and overall impressions.

Results: Sixty-one residents at our emergency medicine program participated in the flipped journal club during the 2015-2016 academic year, with supervision by core faculty. Program evaluation for the flipped journal club was performed using an anonymous survey, with response rates of 70% and 56% for residents and faculty, respectively. Overall, 95% of resident respondents and 100% of faculty respondents preferred the flipped format.

Conclusion: The "flipped journal club" hinges upon well-selected articles, incorporation of social media, and small-group discussions. This format engages all residents, holds learners accountable, and encourages greater participation among residents and faculty. [West J Emerg Med. 2018;19(1)23-27.]

INTRODUCTION

Journal club is an essential component of graduate medical education, used to teach trainees how to critically appraise the literature and integrate evidence-based medicine into practice.[1–3] However, many challenges are encountered when designing an effective journal club structure that actively engages learners and accomplishes these objectives.[4,5,6] Most programs assign designated residents to deliver an oral presentation,[7] while the remainder of the participants have little motivation to prepare beforehand and risk becoming passive listeners. The traditional Socratic method of "calling on" residents may encourage participation, but may also conflict with the desire to create a collegial atmosphere. Another challenge is generating discussion that is appropriate to all levels of training.

At our emergency medicine (EM) residency program, we sought input from residents and faculty to identify strengths and weaknesses of our traditional format in order to prioritize goals and objectives for journal club. We then designed a "flipped journal club" to implement for one academic year prior to program evaluation.

METHODS

Setting

Our residency consists of a postgraduate-year (PGY) 1-3 EM program, as well as two five-year combined training programs in EM/IM and EM/FM, for a total of 61 residents. Our curriculum

includes a monthly journal club held at a restaurant, conference center, or faculty member's home. All residents on EM rotations are required to attend.

Traditional journal club format

Our residents traditionally were assigned in groups of three to lead a journal club. This group would select articles based on the curriculum topic for that block, with approval from a faculty member, and distribute the articles to all participants. On the evening of journal club, the designated residents would each present their chosen article. This was followed by an open discussion among residents and faculty.

Feedback from residents and faculty (through discussions after journal club, unsolicited emails, quarterly class meetings, and Curriculum Committee and Program Evaluation Committee meetings) indicated numerous drawbacks with this format. Some residents were nervous about speaking in front of a large audience. Much of the audience was ill-prepared and disengaged, and the ensuing discussions were generally led by a handful of extroverted residents. Furthermore, the relevance and quality of selected articles was inconsistent. Lastly, we found that residents were using various social media sources rather than reading original research.

Flipped journal club

We developed a new journal club format to effectively engage all learners using three methods: a focus on specific topics associated with landmark articles, incorporation of social media resources, and division into small groups for discussion. These changes were reflective of flipped-classroom models being integrated into other parts of the curriculum.

We designated a senior faculty member (an associate program director [APD]) and a chief resident as a leadership team to champion the redesigned format. Each month, they select an important controversial clinical topic with an associated "landmark article." A group of three residents, comprised of a PGY-1, PGY-2, and PGY-3, 4, or 5, are selected by the chief resident based on schedule availability. The resident group reviews the landmark article and selects an accompanying background article and a social media piece that is relevant to the topic and freely accessible to the residents. These selections require approval by the leadership team.

The articles and the social media selection are distributed to all residents and faculty one week prior to each journal club. The three residents must additionally prepare a "facilitator's guide" with summaries and discussion points (Appendix A). The leadership team reviews this document prior to distribution to faculty small-group facilitators.

On the evening of journal club, all residents are divided into small groups (typically 5-8 members), composed of learners from all levels of training and facilitated by a faculty member. Within the small groups, interns are expected to discuss the background article. The PGY-2 residents present their analysis of the landmark article, followed by the senior residents' critique of the social media piece. Residents truly lead the discussion, while the faculty facilitators pose questions and provide oversight. Following the small-group discussions, everyone reconvenes to openly summarize and debate key points.

Following each session, the three designated residents create a summary of the main discussion points to be electronically distributed to all faculty and residents (Appendix B).

Program Evaluation

In redesigning our journal club, we sought to achieve specific educational outcomes, and improve participant engagement and overall impressions. We initiated the flipped journal club in July 2015, and following one full academic year we evaluated our educational outcome measures using an anonymous online survey (Appendix C). The voluntary survey, previously pilot tested in a sample of the target population, was sent to all EM residents (n=61) and core academic faculty (n=16). To provide a framework for evaluation, participants were asked to first select their personal goals for journal club from a comprehensive list based on prior literature,[1,2,8] and then choose which format most effectively met the educational objectives.

The Christiana Care Institutional Review Board determined that the program evaluation survey was exempt under an educational curricula waiver.

RESULTS

Of the 61 residents who received the survey, 43 responded (70%). Ten were interns and, thus, unable to compare formats. Of the 16 faculty, nine responded (56%), with all having experienced both formats. Four of the seven faculty who did not respond attended journal club only once or not at all during the study period.

We first asked participants to select what they hoped to gain from journal club from a list of options[1,9] (Table 1). Next, we asked respondents to choose which format best facilitated learning objectives, and which was preferred in terms of overall impression. Interns who were unable to compare the two formats were excluded, leaving 33 residents for analysis. Overall, the flipped journal club format was preferred over the traditional format for every domain and there was no difference in preference between faculty and residents (all p-values > 0.05). (see table 2)

Over 90% of the residents reported that they more often arrive prepared for the new format, and greater than 95% responded that the flipped journal club better allowed them to contribute to the discussion. The final question of the survey asked residents if we should continue with the flipped journal club and 95% responded positively. All faculty respondents felt that we should continue to use the new format.

DISCUSSION

In the ever-changing landscape of medical education,

Table 1. Personal goals for journal club (respondents could select more than one). Total number of respondents was 33 for residents and 8 for faculty.

Personal goals for journal club (listed in order of resident responses)	% (#) Selected by residents	% (#) Selected by faculty
Improve my knowledge of current EM literature	80% (33)	100% (8)
Learn from my colleagues about their clinical practice	80% (33)	100% (8)
Appreciate controversies in clinical EM	73% (30)	75% (6)
Gain critical appraisal skills in evaluating the literature	71% (29)	75% (6)
Socialize with colleagues outside of work	66% (27)	88% (7)
Improve my ability to read and understand an article	63% (26)	25% (2)
Better understand sources of bias and limitations	61% (25)	63% (5)
Translate current evidence into my clinical practice	61% (25)	86% (7)
Free food and drinks	59% (24)	25% (2)
Build good habits for my own life-long learning in EBM	56% (23)	88% (7)
Understanding research methods, study design, and statistics	49% (20)	50% (4)
Learn skills that will help me to conduct my own research	24% (10)	38% (3)

EM, emergency medicine; *EBM,* evidence-based medicine.

innovative techniques for engaging learners of all levels of training must continue to be developed and refined. Our innovation uses small groups, focused clinical topics with a related landmark article, and medical education through social media. This format was preferred by both trainees and faculty in regard to personal goals, educational objectives, and overall impressions. The changes to our format reflect the concepts of the "flipped learning" model in which the four pillars include: a flexible environment, learning culture, intentional content, and a professional educator.[10]

The small-group format allows *flexibility* in the pace and the focus of the discussion and increases the level of active participation. In this *learner-centered* setting, residents drive the discussion and stimulate insightful conversations that create opportunities for more senior participants to teach and share experiences. An experienced team *intentionally* chooses impactful articles that merit in-depth review. The works selected by the designated resident teams are vetted to verify relevance and accessibility. Previous literature indicates residents endorse open-access medical education as their most beneficial source of education, yet also reports infrequent review of the references or quality of evidence.[11] The Council of Residency Directors in Emergency Medicine acknowledges the valuable role of social media in enhancing education and recommends that programs integrate social media into curricula.[12] Faculty have a responsibility to help residents sift through this vast resource.[13] Our "flipped journal club" allows *professional educators* the opportunity to fulfill this duty.

There are potential barriers to implementation of this format. Faculty may need training in small-group facilitation. Continued leadership is necessary to maintain high standards in article selection, review social media resources, and hold residents accountable. In our experience, the designated chief resident and faculty spent 1.5-2 hours per month reviewing articles and coordinating with the assigned teams, generally via email. Our program assigns one chief resident to assist with organization and implementation of our educational curriculum, and journal club leadership naturally fits into that individual's roles and responsibilities. This structure may not be in place at all programs.

This innovation may be feasible for other EM programs, as well as other medical specialties. The similarities to the flipped-classroom model used in conference formats will be familiar to most educators. Some programs may also consider adopting individual components of this format to augment their current journal club. Future research may include evaluation of the feasibility of this model in other programs and studying the effectiveness of each individual intervention (such as a pre-post effectiveness study).

LIMITATIONS

Study limitations include a small sample size of participants from a single, large EM residency program as well as a relatively low response rate to the survey, which has potential to bias the results. Validity evidence was not collected for the survey. Potential confounders inherent to the observational nature of our study include changes in core faculty and residents from one year to the next. Furthermore, the study was not designed to assess the impact of the individual components of the flipped journal club model. Lastly, the measured response to our intervention was limited to a post-implementation survey of self-reported goals and objectives obtained after the study intervention.

CONCLUSION

The "flipped journal club" hinges upon well-selected articles, incorporation of social media, and small-group

Table 2. Resident and faculty preference for the "traditional" vs "flipped" journal club format in terms of educational objectives and overall impressions. Total number of respondents was 33 for residents and 9 for faculty.

	Resident preference		Faculty preference		
	Traditional	Flipped	Traditional	Flipped	X^2 (p-value)*
Objectives met through journal club					
Understand study design, research methods, statistics	26% (9)	74% (25)	50% (4)	50% (4)	0.76 (0.38)
Appreciate sources of bias and study limitations	26% (9)	74% (25)	38% (3)	63% (5)	0.03 (0.86)
Appreciate important controversies in clinical EM	14% (5)	86% (30)	13% (1)	88% (7)	0.19 (0.66)
Learn to select articles that might change clinical practice	12% (4)	88% (29)	13% (1)	88% (7)	0.33 (0.56)
Take valuable points from the discussion to apply to clinical practice	3% (1)	97% (33)	13% (1)	88% (7)	0.05 (0.82)
Overall impressions of journal club					
Quality of articles, topic selection	6% (2)	94% (33)	13% (1)	88% (7)	0.01 (0.92)
Social interactions with colleagues	11% (4)	89% (31)	0	100% (9)	0.17 (0.68)
Comfort with participating in discussion, asking questions	6% (2)	94% (33)	0	100% (9)	0.03 (0.86)
Overall value of time spent	6% (2)	94% (32)	0	100% (9)	0.02 (0.88)
Overall satisfaction with journal club	6% (2)	94% (33)	0	100% (9)	0.02 (0.88)

EM, emergency medicine.
* This chi-square test examines whether there was a difference in preference choice (traditional or flipped) for residents or faculty for each domain.

discussions. The format is meant to promote accountability and create an atmosphere that encourages dialogue among all participants. In our study, the modifications to journal club improved the sense of achieving both personal goals and targeted educational objectives, and was strongly favored by residents and faculty.

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Taking Advantage of the Teachable Moment: A Review of Learner-Centered Clinical Teaching Models

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When working in a chaotic Emergency Department (ED) with competing priorities, clinical teaching may be sacrificed for the sake of patient flow and throughput. An organized, efficient approach to clinical teaching helps focus teaching on what the learner needs at that moment, incorporates regular feedback, keeps the department on track, and prevents over-teaching. Effective clinical teaching in a busy environment is an important skill for senior residents and faculty to develop. This review will provide a critique and comparison of seven structured teaching models to better prepare readers to seize the teachable moment. [West J Emerg Med. 2018;19(1)28–34.]

INTRODUCTION

Teaching within the Emergency Department (ED) demands a successful balance between providing efficient medical care while incorporating meaningful educational experiences for learners. Limited time, regular interruptions, institutional lack of rewards for education, and learners at different levels contribute to the challenges of clinical teaching. As a result, the atmosphere of the ED can often create an emphasis for the learner to communicate "just the facts" rather than formulating questions and discussing uncertainties.

Clinical teachers equipped with learner-centered educational strategies can create powerful learning experiences. Effective teachers identify the individual educational needs of learners, teach to those gaps, and provide feedback.[1] Given the steady stream of undifferentiated patients with wide ranging complaints, educators can transform EDs into rich learning environments.

The goal of this paper is to present the reader with a critique of 7 teaching models to optimize learner-centered teaching in busy clinical settings. The table includes a comparative summary. Concrete examples which illustrate the use of the technique are found in Appendix 1. The teaching models share common themes including identification of learner needs, focusing relevant teaching to those needs, and the importance of feedback. The core educational theories in medical education have been previously described.[2]

THE ONE-MINUTE CLINICAL PRECEPTOR/ MICROSKILLS

Description

The original Five-Step Microskills model of clinical teaching is commonly known as the One-Minute Preceptor (OMP).[3] OMP is a learner-centered technique, but the momentum of the educational encounter is driven by the preceptor. It is therefore an excellent approach for novice learners and for those unfamiliar with the technique. The first three microskills identify gaps in learning, while the last three steps provide feedback. Not all steps need to be used in every encounter, and the order of the steps is flexible.

Table. Summary comparison of learner-centered clinical teaching models.

Model	Overview of technique	Core educational theory	Strengths	Limitations
One-Minute Clinical Preceptor/ Microskills	Get a commitment Probe for supporting evidence Teach general rules Reinforce what was done right Correct mistakes Identify next learning steps	Cognitivist Behaviorist Constructivist	Best studied Learner centered/ Preceptor driven Easy to learn Teaches higher level concepts Links clinical teaching and patient care Promotes feedback	Not suited for resuscitations or critical time situations
SNAPPS	Summarize Narrow Analyze Probe Plan Select	Cognitivist Humanist	Learner centered/ Learner driven Greater interaction between preceptor and learner	Training required for both preceptor and learner
MiPLAN	Meeting i: introductions, in the moment, inspection, interruptions, independent thought Patient care Learner's questions Attending's agenda Next steps	Behaviorist Constructivist	Emphasizes role modeling Fosters bedside teaching Highlights importance of setting expectations	Developed for inpatient ward settings not the ED
ED STAT!	Expectations Diagnose the learner Set-up Teach Assess and give feedback Teacher always (role model)	Behaviorist Constructivist	Designed specifically for ED clinical environment Highlights importance of setting expectations	Training required for the preceptors
Aunt Minnie	Pattern recognition	Cognitivist	Well suited for ED clinical environment	Not studied Potential for overemphasis on System I thinking and premature diagnostic closure
SPIT	Serious Probable Interesting Treatable	Cognitivist	Emphasizes broad differential diagnosis Entertaining for learner	Widely used but not studied
Activated demonstration	Assess student's relevant knowledge Determine what student should learn from skill demonstration Guidance for student participation during skill demonstration Demonstrate clinical skill Discuss learning points with the student Set the agenda for future learning opportunities	Behaviorist	Best used for a procedure or skill	Not flexible for other aspects of clinical teaching (e.g. differentials)

ED, emergency department.

1. Get A Commitment

The initial buy-in from the learner is critical, and establishes investment in the case. The learner processes information just collected from the patient, and articulates their own diagnosis or plan. One or two clarifying questions from the preceptor may be helpful but it is important to avoid over-questioning and dominating the encounter.

2. Probe For Supporting Evidence

This step evaluates a learner's knowledge and clinical reasoning. The preceptor explores the information supporting the initial commitment, assists the learner in synthesizing data, and identifies gaps in knowledge or deduction.

3. Teach General Rules

This is an opportunity to teach common take-home points and rules of thumb. Preceptors provide a brief patient care pearl, focusing on principles that are easily applied to other similar cases.

4. Reinforce What Was Done Right

Providing positive feedback to the learner about points of the case where they got it right reinforces competency. Feedback should be case specific and behavior focused. Preceptors can give feedback early to reduce learner performance anxiety and keep learners engaged.

5. Correct Mistakes

This step should emphasize how to correct knowledge gaps or behavior related to patient care. In some cases, an actual mistake may not have occurred, but the focus is on what could have been done better or differently. The preceptor provides specific constructive or formative feedback. It's important to choose an appropriate setting with consideration to privacy.

6. Identify Next Learning Steps

This more recently added practice-based learning and improvement step is a chance for preceptors to ask a clinical question and identify resources for future study. It can also be a time for preceptors to acknowledge their own uncertainty and solve the question together with the learner.

Literature Review

OMP is the best studied of the common clinical teaching models[4]. In studies comparing traditional teaching models and OMP, both learners and preceptors favor OMP.[5-9] In a trial randomizing internal medicine residents to a one-hour OMP training session, students reported significant improvements in residents' teaching scores and these results mirrored the residents' self-reported improvement.[5] In another study, a group of 116 preceptors, those utilizing OMP were more likely to emphasize higher-order thinking.[6] Faculty viewing videos rated OMP more effective and efficient than the traditional model.[7]

In a study evaluating the effectiveness of an OMP faculty development workshop, faculty self-reported improvement in all the microskills. Positive trends in 4 of 5 microskills were noted by learners assessing participating faculty.[8] Another study assessing the impact of an OMP faculty development workshop demonstrated an increase in amount of feedback, and increased preceptor satisfaction.[10]

OMP has been used successfully in a variety of settings. Nursing preceptors reported persistent improvement in their teaching skills.[11] On inpatient wards, senior residents are often in a dual teacher/learner role during inpatient rotations, and OMP allows for modeling of the faculty member.[12]

Recommendation

OMP is an intuitive, easy to apply clinical teaching model that emphasizes higher order learning such as clinical reasoning, includes feedback in every encounter, and is supported by the medical literature. It is especially helpful for novice learners and for junior faculty development.

SNAPPS

Description

SNAPPS aims to encourage both diagnostic and clinical reasoning in a dynamic fashion.[13-15] At the core of SNAPPS is a shift in paradigm where the preceptor no longer plays the central role. Unlike OMP which is learner-centered and preceptor-driven, SNAPPS is both learner-centered and learner-driven, emphasizing autonomous learning. This conceptual interaction finds its precedent in reflective practice.[13] More preparatory training is necessary for SNAPPS than for OMP, and it is therefore used more with senior residents.

Summarize

The presentation should be a concise, relevant summary of the key historical points and exam findings, not to exceed more than half of the total learner presentation.

Narrow

The learner should focus on the most probable 2-3 differentials. The formulation of the differential list will be driven by the learner's baseline knowledge. While this is similar to OMP, the SNAPPS model requires the learner to commit prior to engagement of the preceptor.

Analyze

During this step, the learner leads an appraisal of the differential through a review of the patient's pertinent positives/negatives to compare diagnostic possibilities.

This provides the opportunity for the learner to verbalize his/her clinical reasoning.

Probe

This represents the unique aspect of the model - the learner leads in affirming uncertainty, rather than the preceptor asking questions to uncover gaps in the learner's knowledge or skills. The learner then asks the preceptor questions to close their own knowledge gap.

Plan

A commitment is obtained from the learner through the discussion of the management plan for the patient. The preceptor is used in this step as an information resource.

Select

To close the teaching encounter, a focused learner-directed activity is selected to reinforce principles discussed in the case. Examples may include reading an evidence-based article, presenting a short didactic, or listening to a podcast.

Literature Review

Users of SNAPPS expressed diagnostic uncertainty more often than comparison groups, without adding time to presentations.[14-17] This led to more teaching about clinical reasoning. Acknowledging uncertainty is linked to improved critical thinking skills.[18] While most of the literature on SNAPPS has been generated by the original authors, one study of Japanese junior residents compared SNAPPS and OMP using a simulated patient case. SNAPPS performed better at demonstrating uncertainty and was more positively rated than OMP.[19]

Recommendation

SNAPPS is a well-studied teaching model. Compared with OMP, utilization of SNAPPS provides learners the opportunity to be more active in their learning, including questioning of the preceptor and choosing topics for asynchronous learning. While this technique can be learned at any level, SNAPPS may be most appropriate as learners become more advanced and have identified areas for self-improvement, with these "practice gaps" serving as teaching points.

MiPLAN

Description

Firmly grounded in constructivism and the social learning aspects of behaviorism, MiPLAN helps learners create and utilize new knowledge, and assists learners in becoming self-directed. Showcased as role models, educators are provided with a script that necessitates teaching at the bedside and encourages the setting of expectations and teaching priorities for both preceptors and learners.[20]

M - Meeting

First, preceptors are recommended to schedule a meeting with learners to understand responsibilities and educational objectives.

i - Behaviors for teachers

The "i" section of the MiPLAN details teacher behaviors at the bedside for efficient and respectful interactions.

- Introductions: the team and purpose are explained to the patient
- In the Moment: preceptors stay focused during the learner's oral presentation
- Inspection: preceptors demonstrate patient observation through visual physical examination.
- Interruptions: these are minimized during the presentation
- Independent Thought: preceptors encourage an understanding of clinical reasoning

PLAN - Patient care, Learner's questions, Attending's agenda, Next steps

The PLAN portion of the teaching model establishes teaching priorities for the teacher that allows the highest-yield teaching priorities to take precedent. Educators are not expected to teach to all four priorities but to select a single element as the focus.

Literature Review

The MiPLAN teaching model has been cited in a single descriptive study.[20] There have been no further publications to date detailing its generalizability.

Recommendation

MiPLAN emphasizes the importance of taking the teaching encounter to the bedside. Educators role model professional behaviors in front of learners and include patients in discussions of their own health care plans. Teaching priorities progress from patient care issues, to learners' uncertainties, and the educator's agenda. Finally, the MiPLAN teaching model emphasizes the need for setting expectations, an essential habit of skilled educators, to facilitate high-yield education in clinical settings.

ED STAT!

Description

Emergency Department Strategies for Teaching Any Time (ED STAT!) was developed in response to a lack of a teaching tool designed specifically for the unique ED environment. This contrasts with OMP and SNAPPS, which were originally created for an ambulatory care setting, and MiPLAN which was originally created for an inpatient care setting. The first 2 steps are best performed at the initial

preceptor-learner meeting. The remaining 4 steps are best completed during an individual teaching encounter.[21]

Expectations

This is an orientation to the ED. Preceptors should be clear about how they and the learners will work together. This step is especially important for students. For example, preceptors may feel comfortable with learners "cherry-picking" cases or may prefer a certain oral presentation format. By clarifying expectations on both sides, preceptors create enhanced teaching conditions.

Diagnose the Learner

Knowing the learner's objective makes it easier to provide relevant teaching. Asking "What types of cases do you find challenging?" and "What would you like me to provide feedback on today?" provides insights into the learner's cognitive and behavioral levels.

Set-Up

Using the specific patient care scenario, the preceptor poses a question that will be used as the basis for a teaching point. To focus on medical decision-making, a preceptor could ask "if this patient has right upper quadrant pain, what are 5 important diagnoses?" If the focus is on resource utilization, a pertinent question may be "is this a fracture you would splint yourself rather than consulting orthopedics?"

Teach

Incorporate strategies for effective teaching. Teaching points should be high-yield, concise, relevant to the learner, generalizable to similar patient cases, and evidence or experience based. Using a repository of resources such as Free Open Access Medical Education can be a powerful supplement. If a patient has an interesting physical exam finding, with the patient's permission, summon all learners to the bedside for a demonstration, and encourage active learning.

Assess and Give Feedback

Constructive nonjudgmental feedback, based on direct observation of the learner, is most valuable. It is important to involve the learner in the feedback process by including a self-assessment, where the learner asks the questions of "what did I do well today" and "what could I improve upon for next time?" This self-assessment can also be used as a foundation for preceptor feedback.

Teacher Always (Role Model)

The learner is always watching and learns a great deal implicitly. Preceptors should be aware of body language, verbal, and nonverbal communication always. When teaching, preceptors should acknowledge if statements reflect facts or opinion.

Literature Review

To date, there is one study that evaluated the impact of ED STAT!, finding that preceptors self-reported an increased amount and quality of teaching as well as an increased confidence level with teaching.[22]

Recommendation

ED STAT!'s greatest strength is that it is tailored specifically for the ED teaching environment. There are no other specific ED teaching models reported in the literature. The mnemonic is easy to remember and can be used with a variety of clinical cases. It is not necessary to use the model with every single case. Since this is a recently described teaching model, it may require more faculty development.

AUNT MINNIE

Description

Aunt Minnie is the technique of pattern recognition. Across the room, just by her hat, dress, or manner of walking, your "Aunt Minnie" is immediately identifiable, even without viewing her face. This technique is rapid and well suited for classic textbook clinical presentations. Described for use in an outpatient setting,[23] learners provide the chief complaint and a presumptive diagnosis as the entire presentation. The preceptor then sees the patient, corroborating or correcting the learner's impression. It facilitates exposure of learners to multiple patients in a busy clinical environment as learners rapidly identify representative clinical presentations.

With decision making, System One is heuristic and System Two is deliberate.[24] Aunt Minnie is System One thinking made explicit, with potential for cognitive error. However, experienced clinicians frequently rely on effective heuristics. Pattern recognition is a learned skill, ideally based on exposure to multiple reinforcing examples. Improved diagnostic accuracy has been demonstrated from reinforcing the value of both analytic and nonanalytic reasoning strategies to learners.[25]

Literature Review

Aunt Minnie has not been studied.

Recommendation

Aunt Minnie helps teach pattern recognition. Its benefits include applicability to the busy and diverse ED clinical environment and the opportunity for learners to build a mental database of representative disease presentations. This type of rapid identification can be easily balanced with other more deliberate models.

SPIT

Description

In contrast to the pattern recognition of Aunt Minnie, SPIT is a diagnostic tool that encourages learners to broaden their differentials. The mnemonic stands for:

S = Serious
P = Probable
I = Interesting
T = Treatable

A learner may SPIT any time during a patient's presentation, identifying a serious, probable, interesting, and treatable diagnosis based on initial chief complaint, upon review of nursing records, after evaluating the patient, or when diagnostic results are available. It is often rewarding to see the list evolve as additional information is gathered. SPIT is an engaging and quick technique. Additional discussion is generated by comparing the learner's and preceptor's choices. While original authorship for the technique is unclear, it has been promoted by Dr. Judy Paukert.

Literature Review

SPIT has not been studied.

Recommendation

SPIT is best utilized as an instructional method for organizing and expanding a learner's differential diagnosis by a stratified means. It is repeatable as new information arises. SPIT is especially useful in the ED where the learner is expected to focus on "worst first" and consider life threatening diagnoses, while remaining aware of unusual clinical possibilities.

ACTIVATED DEMONSTRATION

Description

This technique is most useful for a skill or procedure unfamiliar to the learner. It closely resembles the education adage of "see one, do one, teach one." The novice learner is asked to watch out for specific aspects or steps while observing the procedure. The more experienced learner should verbalize the steps of the procedure and take a more active role. The senior learner may supervise others and focus on more advanced techniques or potential complications. After the demonstration, the preceptor "activates" the learner by debriefing, for example by asking the learner to describe what was observed or how they would adjust their technique in the future.

Literature Review

A few papers have described the technique in general[1] and for adaptation to specific groups such as in outpatient pediatrics,[26] critical care,[27] medicine,[28] teaching healthcare disparities,[29] family medicine,[30,31] emergency medicine[32,33] and for faculty development.[34,35] Two studies have demonstrated a measurable impact of activated demonstration. An ambulatory teaching workshop trained 128 participants to use this strategy, finding improvements in learner-focused teaching on a post-test.[35] Another study found statistically significant improvements during a post-intervention Observed Structured Teaching Exercise workshop for teaching senior residents leadership and physical exam skills, using activated demonstration as one of the objectives.[34]

Recommendation

Activated demonstration is a well-established teaching technique that uses explicitly identified goals and teaches to the learner level. It is an easy way to brief and debrief with the learner. It is best used for teaching a skill or a procedure compared to other models which more broadly cover a clinical encounter.

CONCLUSION

Seven clinical teaching models were presented which target different types of clinical encounters, and require variable amounts of facilitator and learner preparation. OMP is the best studied of the models and focuses on learner commitment and feedback. SNAPPS is both learner-centric and learner-driven, stressing uncertainty and questioning by the learner. MiPLAN emphases teaching at the bedside in front of the patient. ED STAT! focuses on identifying the learner's gap and role modeling. Aunt Minnie is a pattern recognition technique ideal for busy shifts with classic presentations. SPIT offers the opportunity to expand differentials multiple times during a teaching encounter. Activated Demonstration involves the learner with specific goals during participation of a skill. An element of faculty development is always important to the success of introducing and practicing teaching strategies, but this review can serve as a template to help educators become more adept and flexible when teaching within the ED. With this armamentarium of clinical teaching tools, today's educator is well prepared to take advantage of the teachable moment.

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Self vs. Other Focus: Predicting Professionalism Remediation of Emergency Medicine Residents

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Introduction: Unprofessionalism is a major reason for resident dismissal from training. Because of the high stakes involved, residents and educators alike would benefit from information predicting whether they might experience challenges related to this competency. Our objective was to correlate the outcome of professionalism-related remedial actions during residency with the predictor variable of resident response to a standardized interview question: "Why is Medicine important to you?"

Methods: We conducted a professional development quality improvement (QI) initiative to improve resident education and mentorship by achieving a better understanding of each resident's reasons for valuing a career in medicine. This initiative entailed an interview administered to each resident beginning emergency medicine training at San Antonio Military Medical Center during 2006-2013. The interviews uniformly began with the standardized question "Why is Medicine important to you?" The residency program director documented a free-text summary of each response to this question, the accuracy of which was confirmed by the resident. We analyzed the text of each resident's response after a review of the QI data suggested an association between responses and professionalism actions (retrospective cohort design). Two associate investigators blinded to all interview data, remedial actions, and resident identities categorized each text response as either self-focused (e.g., "I enjoy the challenge") or other-focused (e.g., "I enjoy helping patients"). Additional de-identified data collected included demographics, and expressed personal importance of politics and religion. The primary outcome was a Clinical Competency Committee professionalism remedial action.

Results: Of 114 physicians starting residency during 2006-2013, 106 (93.0%) completed the interview. There was good inter-rater reliability in associate investigator categorization of resident responses as either self-focused or other-focused (kappa coefficient 0.85). Thirteen of 50 residents (26.0%) expressed self-focus versus three of 54 (5.4%) residents expressed other-focus experienced professionalism remedial actions ($p<0.01$). This association held in a logistic regression model controlling for measured confounders ($p=0.02$).

Conclusion: Self-focused responses to the question "Why is Medicine important to you?" correlated with professionalism remedial actions during residency. [West J Emerg Med. 2018;19(1)35–40.]

INTRODUCTION

Wynia et al. define medical professionalism as a "normative belief system about how best to organize and deliver health care."[1] There is evidence to support that professionalism is critical to the competent practice of medicine. Papadakis et al. demonstrated associations between state medical board disciplinary actions and documentation of unprofessional behavior during medical school[2,3] or residency.[4]

The literature reports myriad strategies to remediate unprofessional behavior. Examples include mental health assessments, professional mentorship, role-modeling, remediation assignments, and building social support networks.[5,6] Despite these many options, residency program directors (PDs) consistently report doubts that their professionalism remediation efforts are effective.[7-9] Hence, the existing literature highlights the challenges of a reactionary approach to professional development.

This paper investigates the relationship between resident lapses in professionalism with residents' responses to the question: "Why is Medicine important to you?" We hypothesized that a greater proportion of residents providing self-focused responses would experience professionalism disciplinary actions compared to residents expressing other-focused values.

Population Health Research Capsule

What do we already know about this issue?
Professionalism is an important clinical competency. State medical board disciplinary actions are associated with unprofessional behavior during training.

What was the research question?
Do resident professionalism remedial actions correlate with responses to the question: "Why is Medicine important to you?"

What was the major finding of the study?
The incidence of professionalism remedial actions was higher among residents with self-focused vs other-focused responses.

How does this improve population health?
This association may aid medical educators in identifying residents who may benefit from additional attention to professional development.

METHODS

The study setting was an academic urban tertiary care military hospital. The study participants were emergency medicine (EM) residents, all of whom were active duty service members. All residents beginning training between July 2006 and July 2013 were eligible for study inclusion except for residents starting training in July 2012 (class of 2015), as the lead author was absent that month. Exclusion criteria included residents opting out of interview participation or unable to participate due to scheduling conflicts.

In July 2006, we started a professional development quality improvement (QI) initiative entailing a standardized interview administered to all residents beginning EM training. The aim was to facilitate faculty teaching of residents through ascertainment of resident professional values, or trans-situational and inherently desirable goals related to their pursuit of a career in medicine.[10] Upon review of the QI data, we believed our findings to be of interest to the medical education community. We subsequently received approval from our institutional review board to analyze the interview data for research purposes (retrospective cohort design).

The PD administered all interviews during the initial month of residency before any educational or clinical evaluations. To maintain a non-threatening environment, he held all interviews in a private room without recordings. The interviews uniformly began with the standardized question: "Why is Medicine important to you?" The PD tailored subsequent interview questions to the individual resident to elaborate on their answers. For example, an initial resident response of "because I want to help people" might be followed by the question "why is helping people important to you?" Other interview questions underwent minor modifications during the study period (Appendix Table), but the first question remained unchanged.

Following each interview response, the PD entered de-identified free-text summaries of the interview responses into a secure Excel database (version 14, Microsoft, Redmond, WA). Upon completion of all interview questions, he showed the text for all responses to the resident for confirmation of text accuracy. He maintained records only of the final text approved by each resident.

The independent variable defining the study cohorts comprised each resident's first unambiguous response to the first interview question: "Why is Medicine important to you?" We defined an unambiguous response as one which we could categorize as being either self-focused or other-focused. Self-focused responses focused primarily on the resident (e.g., "I enjoy the challenge," "I like science"). Other-focused responses focused primarily on others (e.g., "I enjoy helping patients," "I want to help my community").[11] By focusing on the first unambiguous answer we sought to minimize biases in responses resulting from the social nature of the interview (e.g., characteristics of the interviewer and interviewee).[12]

Two investigators not present at the interviews and blinded to any resident identifying information and outcomes

used the interview text summaries alone to categorize each resident's responses as either self-focused or other-focused. If the first response was ambiguous, investigators relied upon the second clarifying response. There were no instances in which investigators required more than the initial two responses to categorize a resident's focus. The PD resolved all discordant categorizations.

Additional data recorded by the PD after each interview included resident age, sex, and number of previous years as a physician. Other data included responses to questions regarding whether religion or politics played an important role in the resident's life (binary variables) and geographic region of upbringing.

The primary outcome was the occurrence of any professionalism remedial actions during residency compared between residents with self-focused versus other-focused responses. We defined remediation as any required actions deviating from the standard curriculum: not all actions were adverse. Examples include individual study plans (e.g., reading professionalism literature, preparing professional development self-reflection essays),[13] written counseling statements, residency probation, and termination. We did not collect data on specific remediation actions taken for each resident in order to maintain resident confidentiality. The decision to start remedial actions rested with a residency committee to which none of the authors belonged. As PD, the lead author was responsible for providing this committee detailed information regarding resident performance. Secondary outcomes included non-professionalism remedial actions (e.g., academic) and residency graduation. We did not collect data on repeat remedial actions. The time horizon over which we measured the primary outcome was the entirety of training for each resident.

We compared characteristics between residents participating in the interviews vs. those not participating to assess for selection bias. We calculated a kappa coefficient to quantify interrater reliability between the two blinded investigators categorizing resident responses to the first interview question as either self-focused or other-focused. We compared all variables and outcomes between residents with self- versus other-focused responses using independent samples Student's t-tests for continuous variables and Fisher's exact test or chi-squared test for categorical variables. We calculated the odds ratios (ORs) of professionalism remedial actions based upon independent variables using a logistic regression model to control for confounders. We used SPSS (Version 22, IBM, Armonk, NY) for all statistical analyses.

RESULTS

Of 114 physicians starting residency during the study, 106 (93.0%) completed the residency entrance interview. The eight remaining residents were unable to participate due to scheduling conflicts on the interview days. The mean age of participants was 31.1 years and 22.6% of participants were female. The proportion of residents undergoing professionalism remedial actions was 15.1%. Examples of actions triggering remediation included absence from assigned shifts, ignoring staff directions, arguments with staff, and negative interactions with patients.

Participant characteristics and outcomes were similar between the 106 participants and eight residents who did not participate. No significant differences existed for any variables between these two groups. Two of the eight residents who did not participate in the interview experienced professionalism remedial actions.

In response to the question "Why is Medicine important to you?," 50 (47.2%) expressed self-focused answers and 56 (52.8%) expressed other-focused answers based upon categorization by the two blinded investigators (kappa coefficient 0.85). Regarding the primary outcome, a higher proportion of residents expressing self- vs. other-focused answers experienced professionalism remedial actions (26.0% versus 5.4%, $p<0.01$). A self-focused response was the only subject characteristic significantly associated with the occurrence of professionalism remedial actions during residency in the logistic regression model controlling for potential confounders: OR 8.9 (95% confidence interval 1.8-45.6, Table 2).

DISCUSSION

This study found an association between self-focused responses to the question "Why is Medicine important to you?" and subsequent resident professionalism-related remedial actions. As described in the psychology literature, self-focus is the conscious direction of attention to one's self whereas other-focus is the conscious direction of attention to others.[11,14] One potential explanation for our finding is the concept of self-complexity, or the "interrelatedness of various aspects of the person's conception of self."[15] Complex selves "subsume a multiplicity of relationships, traits, goals, and commitments."[16] Other-focused responses may reflect residents' views of themselves as embedded in networks of various roles and responsibilities to different groups of people (such as patients, nurses, and the residents' own families and friends). Perhaps residents' self-focused responses reflect a less complex self-concept. People with more complex self-concept may be more resilient to challenges and failures because not every aspect of the self is threatened by setbacks commonly encountered during residency.[15]

Our results contribute to a growing literature regarding physician characteristics and behaviors that correlate with unprofessional behavior. Papadakis et al. importantly highlighted an association between documented unprofessional behavior while in medical school or training and subsequent disciplinary action by medical boards.[2-4] Our investigation expands upon this work by elucidating a resident characteristic that may be identifiable before residents have begun to manifest unprofessional behavior.

Table 1. Characteristics of all interviewed emergency medicine residents starting training during 2006-2013, stratified by self-focused versus other-focused interview responses (n=106).

Characteristics	All residents, n=106	Self-focused, n=50	Other-focused, n=56	p*
Mean age, years	31.1	30.3	31.8	0.12†
Female sex, %	22.6	28.0	17.9	0.25‡
Mean pre-residency time as physician, years	0	0.4	1.0	0.09§
Geographical home of record, %				
New England (CT, ME, MA, NH, RI, VT)	5.7	8.0	3.6	
Mid-Atlantic (NJ, NY, PA)	14.2	14.0	14.3	
East north central (IL, IN, MI, OH, WI)	16.0	12.0	19.6	
West north central (IA, KS, MN, MO, NE, ND, SD)	7.5	4.0	10.7	
South-Atlantic (DA, FL, GA, MD, NC, SC, VA, DC, WV)	15.1	20.0	10.7	
East south central (AL, KY, MS, TN)	2.8	6.0	0	
West south central (AR, LA, OK, TX)	8.5	10.0	7.1	
Mountain (AZ, CO, ID, MT, NV, NM, UT, WY)	18.9	16.0	21.4	
Pacific (AK, CA, HI, OR, WA)	11.3	10.0	12.5	0.33**
Religion as significant life influence (%)	51.9	38.0	64.3	0.01‡
Politics as significant life influence (%)	29.2	40.0	19.6	0.03‡
Graduated residency (%)	95.3	98.0	92.9	0.37‡
Non-professional remedial action (%)	20.8	20.0	21.4	1.00‡
Professional remedial action (%)	15.1	26.0	5.4	<0.01‡

CT, Connecticut; *ME*, Maine; *MA*, Massachusetts; *NH*, New Hampshire; *RI*, Rhode Island; *VT*, Vermont; *NJ*, New Jersey; *NY*, New York; *PA*, Pennsylvania; *IL*, Illinois; *IN*, Indiana; *MI*, Michigan; *OH*, Ohio; *WI*, Wisconsin; *IA*, Iowa; *KS*, Kansas; *MN*, Minnesota; *MO*, Montana; *NE*, Nebraska; *ND*, North Dakota; *SD*, South Dakota; *DE*, Delaware; *FL*, Florida; *GA*, Georgia; *MD*, Maryland; *NC*, North Carolina; *SC*, South Carolina; *VA*, Virginia; *DC*, District of Columbia; *WV*, West Virginia; *AL*, Alabama; *KY*, Kentucky; *MS*, Mississippi; *TN*, Tennessee; *AR*, Arkansas; *LA*, Louisiana; *OK*, Oklahoma; *TX*, Texas; *AZ*, Arizona; *CO*, Colorado; *ID*, Idaho; *MT*, Montana; *NV*, Nevada; *NM*, New Mexico; *UT*, Utah; *WY*, Wyoming; *AK*, Alaska; *CA*, California; *HI*, Hawaii; *OR*, Oregon; *WA*, Washington.

* Values reflect comparisons of characteristics between residents expressing self-focused values versus those expressing other focused values.

† Two-tailed independent samples Student's t-test (equivalent variances by Levene's test).

‡ Fisher's exact test (2-sided).

§ Two-tailed independent samples Student's t-test (non-equivalent variances by Levene's test).

** Chi-squared test.

Table 2. Logistic regression model measuring associations between resident characteristics and the occurrence of professionalism remedial actions (n=106).

		95% Confidence interval	
Variables*	Odds ratio	Lower	Upper
Age	1.1	0.9	1.3
Female sex	0.5	0.1	3.1
Pre-residency time as physician	0.3	0.0	1.5
Pre-residency time as active duty military service member	1.6	0.2	11.5
Religion as significant life influence	2.2	0.6	8.7
Politics as significant life influence	1.3	0.3	5.1
Self-focused interview question response	8.9	1.8	45.6

* All variables are binary except for age for which the odds ratio reflects the association with professionalism remedial action with each year increase.

LIMITATIONS

This study has several limitations. First, it reflects retrospective examination of prospectively collect QI data and so our findings are strictly preliminary and we believe should not lead to or impact remedial actions. To the extent that our data compel educators to be more aggressive in initiating remedial actions among self-focused residents, the association identified in our study may become a self-fulfilling prophecy with the potential to inhibit rather than enhance resident professional development. We believe use of our standardized interview tool to select against residency applicants by trying to predict "problem residents" would be similarly ill-advised.[17] Indeed, while the expression of self-focus to our interview question had high sensitivity in predicting subsequent unprofessionalism, it had very low specificity.

A second limitation is small sample size from a single military EM residency program. Thus, it is difficult to speak to the generalizability of our results to civilian training programs and programs in other specialties. Also our small sample size limited the power of our regression analysis, and it is possible that other important correlates with unprofessional behavior exist.

A third limitation is that the categorization of the independent variable of each resident's reason for valuing a career in Medicine as being primarily other- or self-focused was arguably subjective. We based these categorizations upon the free-text written records of the PD, which were finalized in consultation with each resident at interview completion to ensure accuracy. It is possible that the interview discussion following the resident's response to the first question may have influenced this text record. Further, other interviewers may have either solicited different resident responses or recorded the same verbal responses differently.

Another limitation is our primary outcome measure of professionalism remedial action. Measuring professionalism is complex and the literature describes myriad methods for making this measurement.[18-20] Indeed, research suggests poor inter-rater reliability among academic faculty in determining what constitutes unprofessional behavior.[21] In our training program, the decision to impose a professionalism remedial action was the collaborative decision of a Clinical Competency Committee (CCC).[22] The CCC comprised multiple faculty members, none of whom were involved with this study. The educational literature supports the use of such committees as an effective mechanism for identifying unprofessional behavior.[23] We believe the collaborative nature of these decisions makes this outcome measure more reliable. Nevertheless, it is impossible to say whether the same resident actions would have led to similar remedial outcomes at other programs. Our decision to not collect data regarding each resident's specific remedial action plan to protect resident confidentiality further complicates efforts to extrapolate our experience to other settings.

Future work might study the impact on resident professionalism of other factors not explored in this study including social upbringing, childhood education, hospital environment, and the "hidden curriculum."[24,25] It would also be interesting to administer our interview tool in different contexts. In particular, future studies could examine whether simply educating residents about the association we identified in this study to stimulate their own introspection into the motivations underlying their career choices might be effective in decreasing instances of unprofessional behavior.

CONCLUSION

Self-focused professional values as expressed during our standardized interview correlated with professionalism remedial actions during residency. These results may aid medical educators in identifying residents who may benefit from additional attention to professional development.

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Intern as Patient: A Patient Experience Simulation to Cultivate Empathy in Emergency Medicine Residents

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Introduction: Prior work links empathy and positive physician-patient relationships to improved healthcare outcomes. The objective of this study was to analyze a patient experience simulation for emergency medicine (EM) interns as a way to teach empathy and conscientious patient care.

Methods: We conducted a qualitative descriptive study on an in situ, patient experience simulation held during EM residency orientation. Half the interns were patients brought into the emergency department (ED) by ambulance and half were family members. Interns then took part in focus groups that discussed the experience. Data collected during these focus groups were coded by two investigators using a grounded theory approach and constant comparative methodology.

Results: We identified 10 major themes and 28 subthemes in the resulting qualitative data. Themes were in three broad categories: the experience as a patient or family member in the ED; application to current clinical practice; and evaluation of the exercise itself. Interns experienced firsthand the physical discomfort, emotional stress and confusion patients and families endure during the ED care process. They reflected on lessons learned, including the importance of good communication skills, frequent updates on care and timing, and being responsive to the needs and concerns of patients and families. All interns felt this was a valuable orientation experience.

Conclusion: Conducting a patient experience simulation may be a practical and effective way to develop empathy in EM resident physicians. Additional research evaluating the effect of participation in the simulation over a longer time period and assessing the effects on residents' actual clinical care is warranted. [West J Emerg Med.2018;19(1)41–48.]

INTRODUCTION

Empathy is an important trait for compassionate and effective physicians. A number of studies link positive physician-patient relationships and physician empathy to improved healthcare outcomes,[1,2,3] enhanced patient adherence with recommendations,[4] and improved patient satisfaction.[4,5] A systematic review by Stewart found that empathy and support, clear information from doctor to patient, and shared decision-making were associated with improved outcomes and patient adherence.[2] Additionally, studies show that physician empathy is beneficial to the provider as it is associated with lower rates of physician burnout[6] and fewer medical-legal risks.[7]

In the medical literature, empathy is defined in several ways. Mercer and Reynolds define physician empathy as the ability "(a) [to] understand the patient's situation, perspective and feelings (and their attached meanings); (b)

to communicate that understanding and check its accuracy; and, (c) to act on that understanding with the patient in a helpful (therapeutic) way."[8] Hojat defines empathy as the "cognitive attribute that involves an ability to understand the patient's inner experience and perspective and a capability to communicate this understanding."[9] A simpler definition comes from the Oxford-English dictionary where empathy is "the ability to understand and share the feelings of another."[10]

Empathy is an important topic in undergraduate and graduate medical education. In recent decades there has been an emphasis on teaching and evaluating psychosocial skills such as empathy and concern, as well as on communication skills and shared decision-making. The Association of American Medical Colleges (AAMC) discusses empathy in its Learning Objectives for Medical School Education stating, "physicians must be compassionate and empathetic in caring for patients."[11] The United States Medical Licensing Examination (USMLE) includes an assessment of communication skills for medical students and the Accreditation Council for Graduate Medical Education (ACGME) includes interpersonal and communication skills, professionalism and patient-centered communication in its milestones for many specialties.[12]

In an attempt to teach empathy and to introduce aspects of the patient and family experience to residents, our emergency medicine (EM) residency holds a patient experience simulation for the incoming intern resident class. The purpose of this study was to explore residents' perceptions of the simulation, with particular attention to the development of empathy.

Population Health Research Capsule

What do we already know about this issue?
Research has linked empathy and positive physician-patient relationships to improved healthcare outcomes. A variety of educational interventions have been used to teach and evaluate empathy and psychosocial skills in medical education. Despite these efforts, studies show that empathy may decrease during medical training, which may have direct consequences on patient care and physician well-being.

What was the research question?
Would participation in a patient experience simulation by EM interns during orientation help them to develop empathy for patients and their family members?

What was the major finding of the study?
Conducting a patient experience simulation may be a practical and effective way to nurture the development of empathy in EM residents and foster their responsiveness to patients' needs and concerns.

How does this improve population health?
Implementation of an intervention and curricular tool to cultivate empathy in resident physicians would help improve patient-physician relationships and prevent empathy degradation in medical education. In addition to its value for EM residencies, patient experience simulations could also be developed for interns and students in other specialties.

METHODS

We conducted a qualitative descriptive study and used focus groups as a means of generating study data. In July 2016, all 10 EM interns at the study institution participated in a patient experience simulation during their first week of residency orientation. The study institution is a Level I trauma center and the emergency department (ED) cares for approximately 80,000 patients annually. The EM residency is three years in length, with a total of 28 residents.

This was an in situ simulation, held in the ED. Half of the interns had the role of "patients" injured in a motor vehicle accident. These patients were brought into the ED by a professional ambulance service on a backboard with a cervical collar (C-collar) and were evaluated in the trauma bays by a senior EM resident, a medical student and two nurses. The other half of the interns had the role of "family member" and went through the process of arriving at the ED and locating their family member after an accident. The complete simulation lasted three hours and included a full trauma assessment (including the use of moulage clothing that could be cut off), continuing ED care, time in the family waiting room, transport to radiology, splint placement, the need for pain medications, the need to use the bathroom, the use of crutches and receiving discharge instructions. While efforts were made to make the experience realistic, participants were not irradiated with radiographs, did not have intravenous (IV) lines placed and received no medications. After the exercise, the interns completed a brief evaluation form on their experience and a standard hospital patient satisfaction survey. To conclude the experience, there was a debriefing moderated by faculty members.

All participants in the simulation were invited for a follow-up focus group held during a scheduled research meeting when the majority of residents were available. Focus groups were chosen for data collection in order

to encourage cross-talk and idea generation between the residents. Residents were informed that their participation was voluntary, their responses were confidential, and their decision to participate would not affect their job or standing in the residency program. Eight of the 10 interns were available to participate in the 60- minute focus group.

Residents were interviewed by two investigator moderators [SN, CM] using a semi-structured interview guide. There were 28 questions organized into themes highlighting patient needs, staff communication, challenges with the experience, empathy, and future simulations. (See appendix for Focus Group Moderator Guide.) The focus group was audio-recorded and the recording was transcribed by a CITI-certified transcriptionist. All resident responses were de-identified, kept strictly confidential, and reviewed only by members of the research team. The study was deemed exempt by the Maine Medical Center Institutional Review Board.

Data Analysis

Using a constant comparative method and a grounded theory approach,[13] two investigator coders [SN and CG] identified themes in the resulting qualitative data with phrases as units of analysis. These qualitative methods were appropriate for early exploration of a phenomenon such as this, when the goal was to gain an understanding of participants' views and experiences.[14] The transcripts were first read, generally, to provide an overall impression of the major topics discussed. They were then read line-by-line by the two independent coders. Themes and subthemes were formulated through an inductive process. The coders then met in person to develop a consensus framework. The two investigators then independently recoded the transcripts with this new coding schema, using the process of constant comparative analysis, until new themes no longer were identified in the data (saturation). They then met again to develop a final coding schema.

The investigators used this final framework to code the transcripts for a third time. The investigators adjusted the coding by consensus, following each round of coding in an iterative process. The agreement between coders was excellent on the third round of coding with all unit phrases fitting within the coding scheme. After the final coding, illustrative quotes were selected. To improve readability, we corrected quotes for grammatical errors.

RESULTS

Of the eight interns interviewed, three were in the role of patient and five were in the role of family member. Three were female, five were male, and all were between 26 and 33 years old. All participants were EM interns and none had any prior medical residency training.

Ten major themes and 28 subthemes were identified in the participant comments. The themes fell into three broad categories: the experience as a patient or family member in the ED; the application to current clinical practice; and the evaluation of the exercise itself. See table for themes and illustrative comments.

Experience as a Patient or Family Member in the ED

The intern participants discussed the physical discomfort and the emotional stress of the ED process. They described how the process felt unfamiliar and confusing and they speculated about how patients and families with little medical literacy would feel. Finally they discussed examples of poor communication between ED staff and patients and their families.

The physical discomfort was a surprise to several of the participants. One participant noted, "I did not understand or appreciate that … those C-collars are awful." Another participant noted the discomfort of the monitoring stickers, commenting. "Really painful and awkward."

More impactful than the physical stress was the emotional stress for both patients and family members. The interns commented about feeling vulnerable and feeling anxious. A family member said "you have very little control and you always want answers." A patient commented, "Like when they take off your clothing to do the secondary survey… is very like emotionally uncomfortable." In addition, there were comments about the lack of accommodations for patients and for families and the lack of privacy. There were comments about waiting for information and updates. "[There was a] prolonged wait time for just finding out what the next step was." Finally, participants expressed feeling burdensome to staff. One family member said, "You don't want to be the annoying person that is raising your hand all the time."

The third theme was that patients and family members were unfamiliar with the overall process of ED care. The comments were divided among disorientation to surroundings and being unclear about the plan of care. A patient who arrived on a backboard said, "I got out of the ambulance. I had no idea where I was … 'cause all you could see was the ceiling." Family members were also confused and unsettled to the surroundings. The process of medical care and the flow through the ED was also unclear to participants.

The last theme identified was how poor communication affected their experience. Both patients and family members raised examples of lack of communication as well as of poor communication skills. While most comments reflected a need for more communication, at times the attitudes of staff were felt to be poor.

Application to Current Clinical Practice

The focus groups were held four months into intern year. Three major themes and eight subthemes were formulated about what residents learned or experienced during the exercise and will try to apply to their practice. The residents discussed the importance of good communication skills, the

Table. Themes and subthemes with illustrative comments

Theme	Exemplar comment
Physical discomfort	
C-collar and back-board	I did not understand or appreciate that those C-collars are awful. If I was at all not in my right state of mind, and I was like at all trying to take charge of my healthcare, I probably would have actually considered taking that thing off. It was really, really uncomfortable and painful and digging into my ears
Other	The stickers on your chest, pulling those off, I was missing a patch of chest hair for months. Really painful and awkward.
Emotional stress	
Long wait times	I mean I knew this was a simulation so I knew that somebody would come and get me eventually but I was thinking if I was just some person waiting for my family member, I would see people walk by and it was a long time and if I was probably really here I probably would have looked for somebody and been like "hey do you remember that I'm here?"
Lack of privacy	Patients can hear what you are saying. They don't care about your Facebook because they are having one of the worst days of their lives.
Feeling vulnerable	When they take off your clothing to do the secondary survey ... I am like realizing that that has to be a very vulnerable feeling to be there with a sheet over and you and people you don't even know rolling you ... that would be something I now acknowledge is very emotionally uncomfortable.
Feeling of anxiety	I don't think I have ever really internalized that and thought about how anxiety provoking it could be for those patients. I provide them the verbal reassurance that we are there to take care of you but I don't think I've ever really thought about how stressful that could be to like ask could I please use the bathroom.
Lack of accommodation (for patients and family)	We were in a hallway bed and I always felt like I was in the way. People were pushing beds up and down that hall in that space on the B-side and then there wasn't a chair or anything to sit and I was just kind of dodging everybody constantly.
Feeling burdensome to staff	I felt very self-conscious and that I was asking for something really annoying and taking their time, but the nurse didn't show any sign in her face or tone of voice whatsoever that it was annoying request and was totally professional about it.
Other	Feeling very frustrated and feeling very isolated.
Poor communication	
Lack of communication	It's very anxiety provoking especially when you are in that room initially waiting for information.
Poor communication skills	I never thought that there would be so much abrasiveness associated with being a family member at a hospital even when you are not peppering the staff with questions or raising your hands to ask.
Other	Having no concept of who was communicating with me.
Unfamiliar with overall process	
Unclear about plan of care	There were a lot of things happening at the same time and I also didn't see anybody, so I feel it was just, like there were a lot of things happening at once.
Disorientated to surroundings	I remember not being told where I was going and having no idea where I was.
Unclear expectations of time	There were certain times that we had no idea how long the current activity was going to last and what was up next.
Good communication content	
Providing updates on care	I guess it made me more cognizant of trying to find family members or update them when people tell me that their family members are coming.
Setting expectations on the process	Lying out the visit, which is something I hadn't developed as a first year what actually I can do, what like a typical plan for a patient looks like. But now letting people know about that I feel is really valuable.
Setting expectations on timing	I think setting expectations early on is really important and overestimating time waits is really important.

Table. Continued.

Theme	Exemplar comment
Good communication skills	
Positive interactions with staff	They both have very warm personalities, which helped. Our questions were very well answered. Our concerns were addressed by the attendings. I did notice that your time with them is very, very short. Which is probably realistic, we probably spent less than two minutes with each of them combined ... so most of your time is with the nurses ... which you don't always necessarily realize as a resident or as an attending -- you are not the most important person in the room, it is typically the nurse, and I think this highlighted that in many ways.
Making eye contact	Every time I have a patient in a C-collar I lean over and make sure that they can see my face and explain my role and who I am and all of the people that are around.
Other	Just reiterating good communication.
Good patient care	
Patient advocacy	Acknowledging people's discomfort… that this is a strange experience and be sure to ask questions of how I can make that better for them, just little things.
Responsive to needs and concerns	Just normalized for them if they haven't eaten to speak up and don't feel bad about it, don't feel self-conscious about like bugging us and asking for help if they need anything just because that was something more comfortable from my experience I think to let them know that it's okay to do.
Being cognizant of time	It changed how I think about my patients when it comes to time because I was sitting around waiting for so long. So I realize when something is taking forever, I don't think that I did it previous to this experience, but I go in and say "I am sorry that this is taking so long."
Limitations of the exercise	
Difficult to simulate pain	I feel like pain is such a subjective thing and like we weren't experiencing pain it was really hard to advocate for ourselves.
Prior knowledge or experience	I feel like it was biased though because we knew what that was because I've done it on the other side. It made sense so even if he wasn't explaining it, I still understood.
Strengths of the exercise	
Realistic exercise	I thought that was super valuable to know what it's like to be on that backboard to be looking at the ceiling and have paramedics ask questions.
Role modeling	I just remember the whole time being impressed by [senior resident] really. Being like, I hope I can do that one day.
Future directions	
Keep disorientation and anxiety	I think doing it early before people know the staff and know the location.
New ideas	I would tell us whether or not you want us to give a true history or not, just to clarify what we are supposed to be saying when people ask questions. I would definitely have us like keep wearing those fake clothes. That was really helpful. I think having it as real as possible, so if you want to place IVs, that would have been not outside the realm of possibility. I mean you put the cast on for Pete's sake; you might as well do everything else real.
General support for exercise	Yes (response to: "Do you guys think that this simulation influenced how you care for patients?")
	Yes (response to: "So should we do this next year with the interns?")

importance of good communication content including setting expectations on the process and timing, and the importance of overall good patient care, which included patient advocacy and being responsive to patients' needs and concerns.

Residents described examples of both good and bad communication skills. There were comments about the importance of making eye contact when speaking to a patient, especially patients lying on their backs with C-collars in place. A patient said, "If you're in a C-collar you can't see anything, so you gotta [sic] lean right over them." Residents also described the impact of simply having positive interactions when communicating.

Mentioned often was the importance of good communication content. Participants discussed setting expectations on ED process for patients and family members. One resident commented, "In terms of laying out the visit … I feel is really valuable." In addition, residents discussed the importance of setting expectations about timing for the visit. One resident noted, "I think setting expectations early on is really important and overestimating time waits is really important." Providing frequent updates about care was also formulated as an important subtheme.

A final theme was the importance of good patient care, which pertained to honoring the relationship and trust between caretaker and patient and family members. Participants discussed the need to be a patient advocate. Residents also discussed the importance of being responsive to the needs and concerns of patients and families as representing good patient care. One resident commented it was important to "normalize the experience" and "acknowledge people's discomfort." Finally, residents felt it was important to be cognizant of time with regard to length of stay and time between updates. One resident remarked, "It changed how I think about my patients … I realize when something is taking forever… I go in and say 'I am sorry that this taking so long.'"

Evaluation of the Exercise Itself

The interns were extremely positive about the simulation and commented how useful the act of discussing the exercise in the focus group was to reinforce the experiences and concepts they had learned. In the discussion, formulated themes were the strengths of the exercise, the limitations of the exercise and future directions.

One of the strengths of the exercise was its realism. One resident commented, "I thought that was super valuable to know what it's like to be on that backboard, to be looking at the ceiling and have paramedics ask questions." Some interns also felt a benefit of the exercise was the role modeling, especially by the senior EM resident who was caring for them.

Participants mentioned several limitations of the exercise. The patients were prompted to be in pain and to ask for pain medications. This part of the simulation lacked credibility for the participants. One patient said, "We weren't experiencing pain. It was really hard to advocate for ourselves." The other limitation of the exercise was that interns had prior exposure to the ED and prior medical knowledge. Some felt that this might have colored their simulated experience.

Comments about future directions for the simulation included new ideas and general support for the exercise. Interns valued the feelings of disorientation and anxiety. They also liked the timing during intern orientation as a way to add to the power of the simulation. One resident commented, "I think doing it early before people know the staff and know the location [is important]."

There were comments about new ideas for the exercise. "Maybe take away the cell phones of the patients." Another suggestion was to establish IV access on the patients. One suggestion for improvement was to clarify the relationship between the participant patients and family members and to be more specific when coaching the patient history.

When asked whether the simulation would influence how the interns care for patients and how they empathized there was a resounding "Yes." One participant commented that the focus group itself was useful, "I feel this is a useful thing … [to] reflect what was it like to be a family member or what it was like to be a patient, cause when you start … working like 12 days in a row, you get tired and you … kind of forget." When asked about the timing of the simulation during orientation as well as the length of the exercise, there was also general support. When asked if the orientation should be held for interns next year, there was again a resounding "Yes."

DISCUSSION

Empathy is a vital topic in undergraduate and graduate medical training. In the field of EM, Patient-Centered Communication and Professionalism are two of the ACGME Milestones.[12] In addition, empathy, humanism and professional values are discussed in the Emergency Medicine Doctrine of Professionalism.[15] A growing body of literature has shown that empathy and good communication directly enhance the therapeutic efficacy of physicians[16] and that training in these psychosocial and communication skills is effective.[17] In a recent review of empathy training in medical education by Kelm, the majority of interventions were aimed at medical students.[18] At the same time, several studies show that provider empathy may decline during medical school and residency.[18]

Our study builds on work by MetroHealth Medical Center in Cleveland, Ohio, which conducted a similar patient-experience simulation for its EM residents.[19] At the University of Florida Health Science Center, EM interns experienced the ED process from registration to triage to seeing the hospital bill through a clinical scenario (e.g. sore throat, back pain, headache).[20] At the Long Beach Memorial Medical Center family medicine program, residents were admitted overnight to the hospital.[21] Our study adds to this body of literature by using a qualitative approach to understand the experience and the lessons learned from interns four months after being treated as patients and as family members in a busy ED.

Our study proposes a feasible intervention and curricular tool to cultivate empathy in resident physicians. Participants experienced firsthand many of the challenges of being patients and family members in the ED. They experienced aspects of care including the discomfort of wearing a cervical collar, the emotional stress of waiting for care updates, and the disorientation of the ED setting. The interns felt the simulation taught and reinforced several important aspects of being a conscientious and caring provider. They described good

communication both in terms of content – setting expectations on the process, setting expectations on the timing and providing updates, and in terms of delivery – making eye contact, having positive interactions. They also discussed good patient care in terms of being a patient advocate, being responsive to needs and concerns, and being cognizant of timelines and waits. Several times the interns noted that the process of remembering and discussing the simulation was a valuable exercise to reinforce the aspects of patient care and empathy that they had learned.

A patient experience simulation where learners are placed directly into the environment in which they will be working is a transferable learning experience for residents and medical students in many subspecialties. This seems particularly important for interns who are starting residency and making the distinct transition from medical school into a service role as hospital housestaff. Our patient simulation exercise could be used in EM residencies across the country, and similar simulations could also be developed for interns and students in other specialties. We plan to publish the details of this patient experience simulation so that other educators and residencies may use it in their curriculum.

LIMITATIONS

There are several limitations to be considered when interpreting the findings of this study. First, this work included a small number of participants (8 of 10 interns) from a single academic center. There were also challenges to the fidelity of the simulation exercise for the intern patients. As the participants were not actually injured, it was difficult to simulate the pain experience when they were instructed to request pain medication. In addition, ED staff were not blinded to the exercise: EMS, registration, nursing and ED technicians all knew that the interns were participating in a simulation experience.

Finally, the investigators facilitating the focus groups were the same faculty who organized and ran the patient experience simulation. The investigators discussed their own reflexivity prior to the focus groups and were given an explicit facilitator guide. During the focus groups, ground rules were reviewed and confidentiality was emphasized. Despite this, it is possible that the interns were trying to please the faculty when answering questions. Having an external moderator run the focus group may have allowed interns to be more objective.

CONCLUSION

Empathy, good patient communication, professionalism and humanism are important skills in medicine that not only aid in cultivating the doctor-patient relationship but also improve patient outcomes and physician work satisfaction. Unfortunately, the natural empathy that providers have when they start medical school may wane with the rigors of medical training. To combat this, residency programs must find innovative ways to teach, reinforce and evaluate provider empathy and communication skills.

Findings from this study suggest that conducting a patient experience simulation may be a practical and effective way to nurture the development of empathy in EM residents. Additional research is warranted to evaluate the effect of participation in such experiences over a longer time period and to assess the effects on residents' actual interactions with patients and families while delivering care.

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ACGME Clinical and Educational Work Hour Standards: Perspectives and Recommendations from Emergency Medicine Educators

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Introduction: The American College of Emergency Physicians (ACEP) and the Council of Emergency Medicine Residency Directors (CORD) were invited to contribute to the 2016 Accreditation Council for Graduate Medical Education's (ACGME) *Second Resident Duty Hours in the Learning and Working Environment Congress*. We describe the joint process used by ACEP and CORD to capture the opinions of emergency medicine (EM) educators on the ACGME clinical and educational work hour standards, formulate recommendations, and inform subsequent congressional testimony.

Methods: In 2016 our joint working group of experts in EM medical education conducted a consensus-based, mixed-methods process using survey data from medical education stakeholders in EM and expert iterative discussions to create organizational position statements and recommendations for revisions of work hour standards. A 19-item survey was administered to a convenience sample of 199 EM residency training programs using a national EM educational listserv.

Results: A total of 157 educational leaders responded to the survey; 92 of 157 could be linked to specific programs, yielding a targeted response rate of 46.2% (92/199) of programs. Respondents commented on the impact of clinical and educational work-hour standards on patient safety, programmatic and personnel costs, resident caseload, and educational experience. Using survey results, comments, and iterative discussions, organizational recommendations were crafted and submitted to the ACGME.

Conclusion: EM educators believe that ACGME clinical and educational work hour standards negatively impact the learning environment and are not optimal for promoting patient safety or the development of resident professional citizenship. [West J Emerg Med. 2018;19(1)49-58].

INTRODUCTION

The Accreditation Council for Graduate Medical Education (ACGME) aims to assure a safe learning environment for residents, in part by trying to mitigate fatigue-related medical errors and promote learner wellness.[1,2] To this end, in 2003 the ACGME broadly enacted duty hour standards as part of their common program requirements. However, in 2008, with ongoing patient safety concerns, the Institute of Medicine (IOM) published "Resident Duty Hours: Enhancing Sleep, Supervision, and Safety."[3] This highly publicized report called for more stringent resident work-load and duty hour limitations to better protect patients. Shortly thereafter, the ACGME published their 2011 Duty Hour Standards: Enhancing Quality of Care, Supervision and Resident Professional Development and revised their work hour standards within their core program requirements (Table 1).[4,5]

Even before these revisions, studies evaluating the benefit of work hour limitations demonstrated mixed outcomes.[6,7,8,9,10] One study on patient safety found longer resident work hours to be associated with increased patient length of stay and the number of intensive care unit transfers, but found no association with inpatient mortality or 30-day readmission rate.[11] Others suggested scheduling adjustments made by some specialties to comply with work hour standards resulted in increased physician handoffs,[12,13] creating barriers to efficient patient care.[14,15] Residency training programs report significant challenges trying to balance work hour restrictions and enforcement with patient care and educational experiences.[14,16,17] Even residents themselves have questioned the benefit of work hour restrictions, as one recent study suggests that limitations do not change resident burnout or self-reported fatigue.[18]

In an attempt to improve resident education, the ACGME held its second *Resident Duty Hours in the Learning and Working Environment Congress* in March 2016. The ACGME invited 64 national organizations to submit position papers with recommendations to improve the work hour standards and the learning environment, from which 56 were invited to provide oral testimony to the Congress. The American College of Emergency Physicians (ACEP) and the Council of Emergency Medicine Residency Directors (CORD) were invited to testify on behalf of emergency medicine (EM). In 2017 the ACGME used this input to revise their common program requirements in an effort to improve the learning and working environment for residents.[5]

With this article, we describe the processes and outcomes by which ACEP and CORD collaborated and jointly explored the state of opinion of EM educators on the ACGME's clinical and educational work hour standards, and developed recommendations for the 2016 ACGME *Resident Duty Hours in the Learning and Working Environment Congress*.

Population Health Research Capsule

What do we already know about this issue?
ACGME duty hour standards have been in place since 2003. Their effects on the EM learning environment have not been extensively reported.

What was the research question?
We sought to gain the perspectives of EM educators and make recommendation regarding the future of ACGME work hour standards.

What was the major finding of the study?
Aside from promoting resident wellness, EM educators largely perceive current work hour standards to have a negative impact on patient safety and the educational experience.

How does this improve population health?
Future revisions of ACGME clinical and work hour standards should aim to prioritize all aspects of the learning environment.

METHODS

In response to the ACGME request for organizational position papers and recommendations on resident learning and the working environment, ACEP and CORD engaged in parallel but collaborative efforts to generate informed, consensus-based responses from both organizations. The University of Virginia Institutional Review Board reviewed the completed project retroactively and deemed this descriptive report to be exempt from review.

In 2016 an 11-member working group of experts in graduate medical education (GME) and EM residency training convened and engaged in iterative discussions to offer EM's recommendations for future changes to the dimensions of resident work hour requirements and standards governing key aspects of the learning and working environment. Work group members were purposefully selected through an unstructured discussion process by ACEP academic affairs committee leaders (i.e., authors SW, EG, and HH) for their understanding of, and expertise in, GME and to assure diverse opinions on the learning environment from programmatic, institutional, and national perspectives.

Following broad discussion and commentary, the work group developed and administered a 19-item survey to gain

Table 1. Summary of 2011 & 2017 ACGME clinical and educational work hour standards. [4,5]

Standard	Description
Maximum clinical and educational work (duty) hours	80 hours per week (averaged over 4 weeks), inclusive of all in-hospital call activities and moonlighting. (2011) 80 hours per week (averaged over 4 weeks), inclusive of all in-hospital call, at-home call, and moonlighting activities. (2011 & 2017) EM Specific: 72 hours per week (60 clinical hours, plus 12 hours for educational and non-clinical duties). (2011 & 2017)
Maximum continuous clinical and educational work (duty) period length	16 hour limitation for PGY 1 residents (2011 only) 24 hour limitation for PGY 2 and above (Residents may be allowed to remain on site for up to an additional 4 hours for activities related to patient safety, such as care transition, and/or resident education) (2011 & 2017) EM Specific: 12 hour shift limitation (while working in the emergency department) (2011 & 2017)
Maximum in-hospital on-call frequency	No more than every third night, averaged over 4 weeks. (2011 & 2017)
Minimum time off between scheduled clinical and educational work (duty) periods	10 hours off between all duty periods. (2011) 8 hours off between all clinical work or education periods. (2017) 14 hours free after 24 hours of in-hospital call. (2011 & 2017) EM Specific: At least an equivalent period of continuous time off between shifts as the immediately completed scheduled work period.
Mandatory time off from clinical and educational work (duty)	One day (24 hour period) in seven free from all clinical work and required education activities, averaged over 4 weeks. (2011 & 2017) EM Specific: One day (24 hour period) free from all educational and clinical responsibilities every week (no averaging). (2011 & 2017)
Maximum frequency of in-hospital night float	6 consecutive nights.(2011) No limit (2017)
Moonlighting	Not allowed for PGY1 residents. (2011 & 2017) Counts toward 80 hour per week clinical and educational work limit. (2011 & 2017)
Not included in clinical and educational work (duty) hours standards	Reading, studying, and/or academic preparation away from the hospital.

EM, emergency medicine; *PGY*, post-graduate year, *ACGME*, Accreditation Council for Graduate Medical Education.

feedback regarding the impact of existing ACGME duty hour standards on EM programs in the areas of patient care and safety (five items), programmatic and personnel costs (six items), consultant and EM resident caseload (four items), and educational experience (four items). Respondents were asked to rate the impact of the 2011 ACGME duty hour standards on a bi-directional 5-point Likert scale from significant negative impact to significant positive impact. Comments were solicited within each area of impact (Appendix).

The survey was distributed to a convenience sample of EM GME stakeholders via the CORD organizational email listserv for EM residency programs. This listserv has participation from each of the 167 allopathic and 32 osteopathic accredited EM training programs. These 199 EM GME programs average five listserv members per program for a total listserv membership of 1,034. Members include departmental chairs, vice-chairs, program directors, associate program directors, educational faculty, and program coordinators. We performed survey data analysis using simple descriptive statistics. Comparative statistics were used to highlight significant differences as appropriate. We identified representative comments in each of the four impact areas to exemplify perceived impact in each of the areas.

Informed by relevant resources,[4] the work group's experience, and survey and comment data, the work group engaged in unstructured iterative discussion to develop draft position statements and recommendations in three areas requested by the ACGME: a formal position on current ACGME resident duty hour requirements; dimensions of duty hour requirements; and standards governing key aspects of the learning and working environment. The draft statements were combined, edited and refined to generate independent, consensus-based final recommendations from ACEP and CORD. Each organization's respective board of directors approved their final recommendations prior to submission to the ACGME.

RESULTS

The work group was comprised of four women, four active program directors and six past program directors. All members contributed substantially to the iterative discussions. One hundred fifty-seven EM educational leaders responded to the survey representing 15.2% (157/1,034) of the broader listserv membership. Ninety-two of the 157 (92/157, 58.5%) respondents were program directors, yielding a targeted response rate for EM program directors of 46.2% (92/199). Demographic data, professional positions, and geographic locations of respondents are listed in Table 2. Survey responses are grouped by areas of impact and are presented in Table 3.

The impact of the ACGME duty hour standards is reported to have had a majority negative effect in all four domains (i.e., patient care and safety, programmatic costs and personnel, resident case load and competency, and educational experience), although the magnitude of negative impact was least in most of the education experience categories. The only positive impact found was fostering resident work-life balance and wellness. Representative comments selected from 233 completed text fields pertaining to individual areas of impact are presented in Table 4.

Table 2. 2016 ACEP-CORD survey of emergency medical educators perceptions on the impact of the ACGME clinical and educational work hour standards – respondent demographics.

	N (%)
Respondents (total)	157 (100)
Program directors (PDs)	92 (59)
Associate PDs	33 (21)
Assistant PDs	14 (9)
Chairs	4 (3)
Clerkship director	3 (2)
Vice chair	4 (3)
Chief residents	1 (1)
Other	3 (2)
Program geographic location	
East	52 (34)
Midwest	41 (26)
Southeast	35 (23)
Southwest	7 (5)
West	18 (12)
Program format	
PGY 1-3	115 (74)
PGY 1-4	40 (26)

PGY, post-graduate year; *ACEP*, American College of Emergency Physicians; *CORD*, Council of Emergency Medicine Residency Directors; *ACGME*, Accreditation Council for Graduate Medical Education.

The final ACEP and CORD formal position statements on ACGME duty hour standards and recommendations for future changes in both the dimensions of duty hour regulation and standards governing key aspects of the learning and working environment are listed in Table 5.

DISCUSSION

Informed by feedback from EM GME educators, our collaborative, consensus-based process found that the ACGME clinical and educational work hour standards are believed to have overall negative effect on the balance of patient safety and the educational experience. EM educators believe broad work hour regulations have adversely impacted the number of patient handoffs, length of stay, boarding, resident case load, hospital costs, and faculty work load in GME. In addition, the ability of training programs to deliver an effective didactic curriculum and assure resident professional citizenship and accountability has been hampered. The only areas of perceived positive impact were resident wellness and a program's ability to foster it.

Residency training programs commit to promoting a supportive educational learning environment. In doing so, programs must balance the resident training experience and educational opportunities with resident wellness and patient safety to create a meaningful and effective educational experience. The ACGME strives to ensure this optimal balance through established work- hour standards for residents.[4] However, EM educators feel that these work hour standards jeopardize the development of personal responsibility and professional accountability that programs work diligently to entrust to their trainees. Furthermore, they are believed to be onerous and cause unnecessary hardship for programs as they monitor and enforce the mandate. *EM educators believe that ACGME work hour standards have historically fallen short of their intended outcomes for patient safety and the educational experience, compromising residency programs' ability to maintain an ideal learning environment.*

Patient safety is known to be adversely affected by fatigued decision-making, excessive transitions of care, and, in the emergency department (ED), prolonged length of stay and departmental boarding.[3,4,19,20,21,22] While ACGME work hour standards are intended to mitigate fatigued decision-making, evidence suggests that they may not be reducing medical errors as expected.[1,10] EM educators believe that work hour standards jeopardize patient safety by increasing transitions across the continuum of patient care and increasing lengths of stay and boarding in the ED. The episodic nature inherent to our specialty's care allows for EM shift-based schedules to align well with the current ACGME standards. On the other hand, inpatient services do not have the same workflow and frequently are not engaged in straightforward episodic care. For them, the implementation of work hour standards has resulted in an unintended increase in transitions of care and a concomitant loss of patient continuity. EM educators perceive these changes as

Table 3. 2016 ACEP-CORD Survey of Emergency Medical Educators Perceptions on the Impact of the ACGME Clinical and Educational Work Hour Standards – Quantitative Responses.

Domain	N	Significant negative impact (1)	Negative impact (2)	Neutral (3)	Positive impact (4)	Significant positive impact (5)	Mean
Patient care/safety impact							
No. of EM-EM handoffs	157	10	44	101	2	0	2.61
No. of consultant-consultant handoffs	156	36	67	49	4	0	2.13
Consultant competency	156	14	56	75	10	0	2.52
ED LOS	157	17	67	70	3	0	2.38
ED boarding	157	31	54	67	5	0	2.29
Programmatic costs/ personnel impact							
Departmental clinical operations costs	157	15	59	81	2	0	2.45
Hospital clinical operations costs	154	27	86	38	2	1	2.12
Educational leadership (e.g., FTEs)	156	15	66	70	4	1	2.42
Educational administration (e.g., FTEs)	156	20	68	64	3	1	2.34
Faculty workload	157	23	73	57	4	0	2.27
Resident workload	157	12	53	54	34	4	2.78
Resident case load impact							
No. for cognitive competency – EM residents	156	4	33	118	0	0	2.74
No. for cognitive competency – consultants	153	17	75	60	1	0	2.29
No. for procedural competency – EM residents	156	4	34	118	0	0	2.73
No. for procedural competency – consultants	152	14	81	57	0	0	2.28
Educational experience impact							
Effective delivery of a didactic curriculum	156	9	58	81	6	2	2.58
Foster professional citizenship/accountability	156	29	54	68	5	0	2.31
Foster academic involvement/service	155	10	55	70	18	2	2.66
Foster resident work-life balance/wellness	155	4	12	65	68	6	3.39

ACEP, American College of Emergency Physicians; *CORD*, Council of Emergency Medicine Residency Directors; *ACGME*, Accreditation Council for Graduate Medical Education; *EM*, emergency medicine; *ED*, emergency department; *No*, number; *LOS*, length of stay; *FTE*, Full-time equivalent.

negatively impacting patient flow in the ED by requiring more handoffs both during the consultation process and in the inpatient setting, creating barriers to efficient and safe patient care across the continuum of care. Additionally, this is believed to have a trickle-down effect of increasing the consultation times, prolonging length of stay, and increasing ED boarding.[23] Given that previous studies have linked ED length of stay and boarding of inpatients to increased patient morbidity and mortality,[19,20,21,22] *EM educators encourage the ACGME to consider specialty specific work hour standards allowing for greater alignment of work hour regulations with individual specialty workflow.*

Resident and faculty attendance at didactic conferences is critical and necessitated by ACGME program requirements.[24] Unfortunately, overlaying conference attendance requirements on the shift-based paradigm that is typically required to meet clinical and educational work hour requirements dramatically decreases a program's and resident's ability to be flexible with educational or clinical time. By functionally locking a resident into very distinct work and didactic obligations with strict work hour parameters, residents are not able to autonomously flex their time to promote personal or career development priorities nor to address their personal learning needs. Residents have limited ability to move clinical shifts without violating work hours or compromising conference attendance. Ideally, any standards would afford programs and residents a degree of flexibility to allow individual educational experiences to be maximized.

Both schedule alterations necessary to comply with work hour standards and monitoring of clinical and educational hours

Table 4. 2016 ACEP-CORD Survey of Emergency Medical Educators Perceptions' on the Impact of the ACGME Clinical and Educational Work Hour Standards – Representative Comments.

Domain	Comment
Patient care and safety	• Decreased [duty] hours have led to decreased experience of longitudinal care and stabilization of patients. It also leads to increased handoffs and a decreased sense of responsibility to drive the patient's plan of care forward in an expedited fashion. This leads to longer time to decisions, admissions, discharges and overall increases boarding. • There are now increased handoffs among consultants leading to increased transition of care times, decreased knowledge about patients, which all has downstream impact on the care provided in the ED. • Boarding is a big issue at most facilities. Often times it is because the inpatient services cannot disposition or discharge patients in a more timely fashion. That may be due to night float or call systems of coverage (but not primary management) as a way to avoid duty hour violations, leaving the bulk of the work to the day teams. This backs up the ED by creating boarders, which ultimately impacts care of new patients arriving to the ED, as well as the stress level and education of the residents working clinically in the ED.
Programmatic and personnel costs	• It is a total waste of time to be chasing someone around and filling out reports because they stayed an hour later and then came to conference the next day without enough sleep. This will be their life, so why not practice for it. I am not in favor of 24-hour shifts at all as they are counterproductive on every service, but if the ICU block would be better served by having the ability to do 7 nights in a row and then have 2 days off, vs. 6 nights in a row, one off, then 1 more night, from a 'wellness' perspective it definitely matters. If you don't work nights (I would imagine most 9-5 administrators do not), then these administrators probably don't get it, but having worked 20 years of nights it is very disruptive. I think total duty hours, protected time for conference, etc. are a good idea. • The residents may have a "better" workload, but they are also seeing less in three years than with the previous rules. • The negative impact on educational leadership is more time spent on dealing with duty hours issues and less time spent on the administration of the education components and innovation. Resident workload has decreased and exposure to patients has decreased while faculty workload has increased, thereby decreasing faculty availability for educational opportunities and faculty fatigue. The clinical operations cost has also increased as hospitals have worked to increase APPs' availability and increase faculty numbers to address holes in schedules.
Resident case load	• I think people are still competent, but I think it takes longer to get to that point. Particularly for consultants. • Also teaching residents that it is more important to leave on time than to complete care and also negatively impacting sense of ownership. My residents now have a more difficult time transitioning to junior faculty roles as a result of being coddled by the rules. • I think things are worse but "sufficient" • The number of patients per resident decreased significantly. Our overall effect is that there is no change, but that is because we went from a 3-year to a 4-year program.
Educational experience	• Ironically, the requirements for documentation of hours and other ACGME requirements have taken the place of clinical work. • The residents should have the power to have more flexibility in their duty hours and scheduling. Safe patient care is enhanced by rested, healthy resident physicians. However, the time and activity each individual needs to stay well is variable and personable. I recognize that some programs at some sites are malignant and would use the flexibility to hurt residents to provide service. However, the vast majority are not and taking the handcuffs off of the creativity with the schedule would likely lead to healthier physicians and better patient care. Consider providing more leeway for "violations" for each resident. At a minimum give a defined number of times they can "violate" so if they want to work a couple extra days in a row so they can have an extended weekend away with family, etc., they can do that. • The documentation and reporting requirements have spawned unbelievable amounts of work for programs and for GME personnel and hospital leadership. Great example of "well intentioned" (I guess) regulations being implemented without sufficient examination of the unintended consequences and questionable rationale. I would say, however, that the effect on non-EM rotations has been healthy -- no more 36-hour calls, no residents who were too tired to think or care. On the other hand, residents got a heavy dose of autonomy and responsibility in the old days that they will not get under the current over-supervised regime. The duty hours have also produced a lot of disdain for honest and accurate reporting. • While I believe that duty hours have become too cumbersome, inflexible and irrelevant, it has given guidelines and quantification of resident time in order to help achieve a balanced life. • Because EM was already shift-work, and already had a more humane approach to training than many medical specialties, we did not see much impact from the duty hours restrictions to our trainees from a clinical perspective. It does make it much more complex and artificially restricted with respect to our non-clinical educational and service obligations (and opportunities).

ACEP, American College of Emergency Physicians; *CORD*, Council of Emergency Medicine Residency Directors; *ACGME*, Accreditation Council for Graduate Medical Education; *ED*, emergency department.

Table 5. Summary statements from ACEP and CORD submitted for the 2016 ACGME Congress on the Resident Learning and Working Environment.

	ACEP statements	CORD statements
Formal positions on 2011 ACGME resident duty hour requirements	• ACEP supports resident duty hour requirements to improve patient safety, promote resident wellness, and enhance learning. • At present, ACEP has concerns about the impact of resident duty hour requirements on patient safety, quality of training, and costs. • ACEP believes resident duty hours should be revised to better support the educational experience. • ACEP believes that the ACGME should explore specialty-specific duty hour requirements for all specialties.	• CORD supports the concept of resident duty hour requirements to promote a supportive educational environment with resident wellbeing and patient safety. • CORD has concerns about the effect of resident duty hour requirements on patient safety, transitions of care, quality of training, and costs. • CORD believes resident duty hours should be revised to better support the educational experience for trainees. • CORD recommends that the ACGME establish specialty-specific duty hour requirements for all specialties.
Formal recommendations regarding dimensions of resident duty hour requirements.	• ACEP supports the use of evidence-based resident duty hour dimensions to the end that they improve patient safety and resident wellness. • ACEP recommends that the ACGME revise the current dimensions to take into account the need for programmatic autonomy and flexibility germane to adult learning and professional development. • ACEP recommends absolving residency programs of the administrative burden of monitoring external moonlighting. • ACEP recommends that the ACGME revise these dimensions in a way that maximally promotes and fosters professional citizenship, patient accountability and academic service.	• CORD supports duty hours that will enhance patient safety and resident wellness. • CORD recommends the ACGME provide more flexibility in duty hours to provide for resident scheduling flexibility and professional development. • CORD recommends absolving residency programs of monitoring external moonlighting hours. • CORD recommends revising duty hours to promote professional citizenship, patient accountability and academic service.
Formal recommendations regarding standards governing key aspects of the learning and working environment.	• ACEP supports efforts to study the effects of relaxing duty hours monitoring and reporting. • ACEP recommends that all trainees not on EM rotations be limited to 24 hour continuous scheduled duty hours, regardless of their level of training. • ACEP supports a minimum rest interval between duty hour periods for shifts twelve hours or less, and a 14-hour rest period after shifts exceeding 24 hours. • Rotating residents should be subject to the duty hour standards of the host rotation program.	• CORD endorses further research to determine the value of a change in the frequency of oversight of monitoring duty hours and their reporting. • CORD endorses a maximum shift length for all trainees of 24 hours of continuous duty. This would apply to hospital-based rotations on floors and critical care units but be exclusive of the emergency department where maximum shift length would remain 12 hours. • CORD endorses a 14 hour period of time off for a shift length of 24 hours. For those shifts that are 12 hours or less, a minimum period of time off is expected between shifts. • CORD endorses that residents rotating from outside the department's home program should be held to the same duty hour standard(s) that apply to the service they are rotating on.

ACEP, American College of Emergency Physicians; *CORD*, Council of Emergency Medicine Residency Directors; *ACGME*, Accreditation Council for Graduate Medical Education.

have had an additional economic impact on institutions. First, the cost of replacing off-service trainees who are repatriated to their home training programs to fulfill service obligations can be substantial. There are no specific data to determine the amount lost; however, surrogate costs are available. For example, providing just eight hours of care daily by advanced practice providers in the ED can result in substantial costs to a department or organization. It stands to reason that similar effects are felt by other specialties as their resident workforce hours are decreased. Institutions potentially need to re-allocate dollars to fund coverage for changes created by the duty hour standards, shifting funding away from educational programs. Thus, a system has

been created by which there is less funding for education without a definitive increase in patient safety or training effectiveness.

Given the increased administrative burden of logging and monitoring resident time, many residency programs have needed to expand their administrative support.[17] Hidden costs for both residency programs and GME offices in order to meet this unfunded mandate cannot be ignored. Compliance has required in some cases that programs purchase electronic management systems and devote faculty and administrator time to review and monitor data. Some have argued that savings from work hours-related improvements in patient safety may justify the increased personnel and administrative costs.[25] However, *EM educators still believe the ACGME must explore ways to decrease the programmatic administrative burden of monitoring work hour standards compliance.*

Another significant concern is the notion that the current emphasis on work hour monitoring appears to engender a "clock punching" mentality, de-emphasizing service, professional citizenship, and personal investment in one's craft – all critical components of professional development for physicians. Though current requirements allow for continuous work hour limitation exceptions when caring for sick patients, the need to document explanations for these exceptions imposes additional administrative burdens on residents, often resulting in a punitive effect rather than rewarding desired behavior. *EM educators encourage the ACGME to consider greater flexibility in clinical and educational work hour standards to promote resident wellness while allowing for the greater development of professional citizenship.*

Currently, two large studies investigating the impact of flexible duty hours on resident training are granted work hour waivers.[26,27] Initial data from the Flexibility in Duty Hours Requirements for Surgical Trainees (FIRST) Trial suggest that increased work hour flexibility was not associated with worse patient outcomes or decreased satisfaction with residents' own well-being or the quality of their education.[26] Interestingly, while program directors in this trial perceived more positive effects on safety of patient care, continuity of care, and residents' ability to attend educational activities, they felt flexible work hours had a positive effect on resident well-being.[28]

The second trial, Individualized Comparative Effectiveness of Models Optimizing Patient Safety and Resident Education (iCOMPARE), is also a large, multi-institutional study designed to evaluate the efficacy and safety of less restrictive work hours in internal medicine training programs.[27] Importantly, this study will evaluate the impact of relaxed work hour restrictions on the measures of patient safety and trainee education. Data from both of these studies will help to inform future clinical and educational work hour restrictions in all specialties.

In spring 2017, the ACGME announced revisions to subsections of the common program requirements pertaining specifically to the regulation of the learning and working environment.[5] These revisions place greater emphasis on patient safety, quality improvement, supervision and accountability, resident and faculty well-being, and professional development. Simultaneously, they aim to provide greater flexibility to programs and residents in defining their own learning and working environment, minimizing the burdensome documentation requirements for residents and programs alike.[5] The impact of these revisions is not yet known. Moreover, the changes to the work hour rules do not address all the concerns identified by the EM community as outlined in our work. Consequently, opportunities exist to determine the specific impact of the more restrictive EM, as compared to non-EM, work hour requirements on ED patient safety and the professional development of EM residents.

LIMITATIONS

Our informed consensus-based process for developing recommendations for the ACGME was limited in several ways. First, our survey instrument was primarily derived using input from workgroup members with expertise in EM and medical education, and their personal experience and understanding of the literature. Given the significant time constraint imposed by the ACGME for each organization's formal position paper, our survey was informed by a limited literature review and we were not able to confirm response process validity by piloting the survey for readability and clarity. It is possible that important topics were misunderstood or excluded from the survey instrument. However, while the overall survey response rate was low (15.2%), the response rate from program directors—those most likely to be familiar with ACGME regulations and their effect on trainees—was better (46.2%). Still, with less than 50% of program directors responding to the survey, there is the potential that our conclusions do not accurately represent all program directors' opinions, despite including input from the broader GME community.

Additionally, open comments were solicited and reviewed by the work group allowing for all opinions to be considered. Next, with an average of 5.2 listserv members per program, any given institution could have answered the survey more than once. The respondent characteristics suggest that there was broad response, but there is still a possibility that over-representation from one institution may have affected the survey results. Next, we recognize the possibility of bias affecting our results. The survey instrument was created by a group of medical education experts, all of whom work (or have worked) within the ACGME program requirements. While survey categories and questions could have been biased towards outcomes favored by the workgroup based on their collective experience, the creation of the initial survey instrument was guided by existing relevant literature. Moreover, there was diverse input from several EM stakeholders and qualitative responses were reviewed and incorporated into iterative discussion minimizing the risk of any bias from the small work group. Lastly, our qualitative commentary data was not formally coded, but rather iteratively discussed by the expert

working group to inform commentary and to derive position statements and recommendations.

CONCLUSION

Emergency Medicine educators believe that ACGME clinical and educational work hour standards have historically negatively impacted the learning environment and do not optimally promote patient safety or the development of resident professional citizenship. EM educators hope that the 2017 revisions to the ACGME clinical work and education standards prioritize all aspects of patient safety, resident wellness, and the ideal learning environment.

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Fantastic Learning Moments and Where to Find Them

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Introduction: Experiential learning is crucial for the development of all learners. Literature exploring how and where experiential learning happens in the modern clinical learning environment is sparse. We created a novel, web-based educational tool called "Learning Moment" (LM) to foster experiential learning among our learners. We used data captured by LM as a research database to determine where learning experiences were occuring within our emergency department (ED). We hypothesized that these moments would occur more frequently at the physician workstations as opposed to the bedside.

Methods: We implemented LM at a single ED's medical student clerkship. The platform captured demographic data including the student's intended specialty and year of training as well as "learning moments," defined as logs of learner self-selected learning experiences that included the clinical "pearl," clinical scenario, and location where the "learning moment" occurred. We presented data using descriptive statistics with frequencies and percentages. Locations of learning experiences were stratified by specialty and training level.

Results: A total of 323 "learning moments" were logged by 42 registered medical students (29 fourth-year medical students (MS 4) and 13 MS 3 over a six-month period. Over half (52.4%) intended to enter the field of emergency medicine (EM). Of these "learning moments," 266 included optional location data. The most frequently reported location was patient rooms (135 "learning moments", 50.8%). Physician workstations hosted the second most frequent "learning moments" (67, 25.2%). EM-bound students reported 43.7% of "learning moments" happening in patient rooms, followed by workstations (32.8%). On the other hand, non EM-bound students reported that 66.3% of "learning moments" occurred in patient rooms and only 8.4% at workstations ($p<0.001$).

Conclusion: LM was implemented within our ED as an innovative, web-based tool to fulfill and optimize the experiential learning cycle for our learners. In our environment, patient rooms represented the most frequent location of "learning moments," followed by physician workstations. EM-bound students were considerably more likely to document "learning moments" occurring at the workstation and less likely in patient rooms than their non EM-bound colleagues. [West J Emerg Med. 2018;19(1)59–65.]

INTRODUCTION

Experiential learning is critical for successful growth and the development of new skills and behaviors. Kolb's four-part experiential learning model, which incorporates concrete experience, reflective observation, abstract conceptualization, and active experimentation, can be used in a recurring cycle that supports progressive new learning (Figure 1).[1] While previous work has discussed these processes as they apply to medical trainees,[2] there is little literature exploring current mechanisms of information transfer in the modern clinical learning environment. As educators refine their skills to meet the needs of today's learners, a deeper understanding of exactly where experiential learning occurs will inform medical education theory and practices.

The classic model of bedside teaching has been in decline.[3] Pressures on academic faculty to care for more patients in less time, and to increase their documentation, billing, and academic productivity, have created often seemingly insurmountable barriers to bedside teaching.[4] These time pressures are particularly relevant in emergency medicine (EM); while overall faculty-resident interaction time was as high as 20%, direct observation time of residents interacting with patients by faculty was only 3.6%. On the medicine wards, it is as little as 1% of the time.[5] These data highlight the importance of maximizing learner-educator interactions at the patient's bedside and elsewhere in the clinical learning environment. Improving our understanding of where such interface occurs is crucial to optimizing them.

Population Health Research Capsule

What do we already know about this issue?
Despite playing a crucial role in learner development, there is little literature exploring how and where experiential learning is happening in the modern clinical learning environment.

What was the research question?
We used data from "Learning Moment" (LM) to determine where learning experiences were occuring in our emergency department (ED).

What was the major finding of the study?
Patient rooms represented the most frequent location of "learning moments" in our ED, followed by physician workstations.

How does this improve population health?
Using LM to determine the location of learning experiences has the potential to inform the design of optimal learning ecosystems and maximize experiential learning for future trainees.

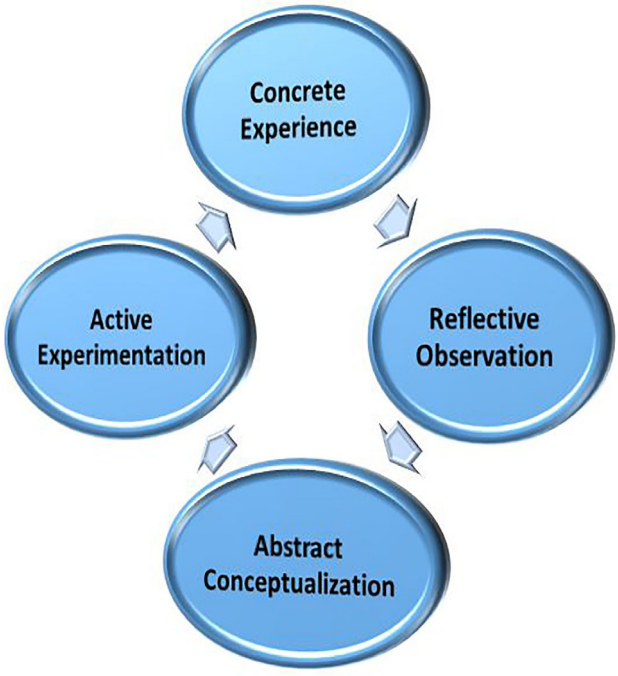

Figure 1. Kolb's experiential learning cycle.[1]

We created a novel, web-based educational tool called "*Learning Moment"* (LM) that integrates the principles of asynchronous learning[6] in order to foster experiential learning. Although most clinical learning environments offer some aspects of Kolb's learning model (experiences and active experimentation), they rarely provide learners with an organized approach to reflective observation and abstract conceptualization.[1] LM fulfills these missing elements to help learners learn better at work.

Our goal in this study was to use data captured by LM as a research database to determine where learning experiences were occuring within our emergency department (ED) clinical learning environment. We hypothesized – based on our own experiences and on recent literature (described above) demonstrating that faculty-learner interactions often occur in locations away from the bedside[3,5] – that clinical learning would occur more frequently at physician workstations as opposed to the bedside.

METHODS

Intervention

We completed the initial build of LM (www.learningmoment.org) to encourage the reflective and abstract

conceptualization steps of Kolb's experience learning model. The LM platform (Figure 2) is designed to serve three main functions:

1: Provide learners with a "note-taking" platform to log learning experiences of their own choosing in the form of "learning moments". Doing so allows for synthesis of such experiences into coherent thoughts, enhancing understanding and retention through self-reflection.

2: Create a searchable and shareable repository of useful, practical, high-yield educational content in the form of a Community Feed (Figure 3) that benefits our entire learning community: Sharing "learning moments" online and in person provides opportunity for abstract conceptualization.

3: Use the data collected from LM to better understand the current state of experiential learning in the clinical environment – starting with, where does learning occur?

Implementation

We implemented LM at a busy (130,000 annual ED visits) tertiary care hospital that hosts a postgraduate year 1-4 EM residency with 12 residents per year, as well as robust third- and fourth-year medical student (M3 and M4) clerkships. As part of the monthly student orientation, MS3s and MS4s were introduced to and registered on the LM platform by research assistants. Demographic data, including the student's intended specialty and year of training were collected at the time of user registration. Students were encouraged to use our platform to log learning experiences during their clerkship without a formal requirement to do so. Students logged self-selected learning experiences in the form of "learning moments" that included the clinical "pearl," clinical scenario, and location where the "learning moment" occurred, among other optional data variables. Students were encouraged to log onto LM and view the Community Feed to read about "learning moments" logged by their peers.

While peer reflection can promote critical thinking, previous work has stressed the role of faculty facilitators to provide oversight in the reflective process.[7] Therefore, a faculty review panel consisting of three EM board-certified attendings oversaw the LM website to ensure content validity and Health Insurance Portability and Accountability Act compliance. We held monthly in-person "*Learning Moment* Reflection" sessions led by experienced clinical faculty in small-group format. These sessions provided medical students with additional opportunities to discuss and expand upon the "learning moments" that they had already logged in order to deepen their understanding through further reflection and abstract conceptualization. A link to the LM website was made accessible directly from the electronic medical record to promote ease of access. Our study was approved as exempt by our institutional review board.

Analysis

We presented data using descriptive statistics with frequencies and percentages, and we stratified locations of learning experiences by specialty and training level. Fisher's exact test was used to compare the distribution of locations between groups. We used SAS v9.3 (SAS Institute Cary, NC) for all data analysis.

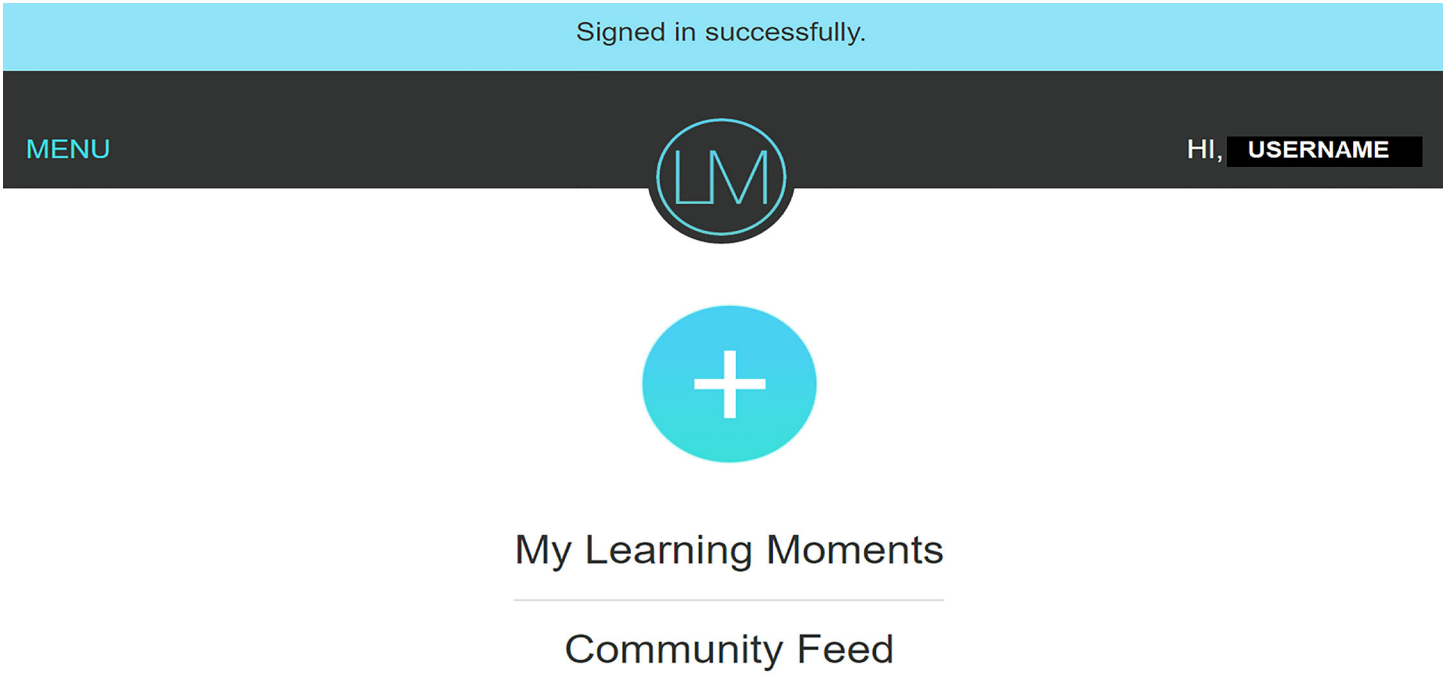

Figure 2. *Learning Moment* interface.

Pearl	Date ▲	Learner	Categories
Acute chest in sickle cell patients: Chest pain, need new findings on CXR.	09/28/16	**Student 1**	Gathering History
3 ways cocaine can cause chest pain: vasospasm, sympathomimetics (tachy and dissection), platelet dysfunction causing clotting	09/28/16	**Student 1**	Gathering History
Elevation of the anterior fat pad to create a silhouette similar to a sail is known as a "sail sign" and indicates elbow joint effusion.	09/28/16	**Student 2**	
Loperamide (Imodium, opioid agonist) has sometimes been abused by using in extremely high quantities.	09/28/16	**Student 3**	Pharmacology
Isopropyl alcohol aroma inhalation can be an adjunct treatment for nausea and vomiting, including in hyperemesis gravidarum.	09/27/16	**Student 4**	Evidence-Based Medicine

← Previous 1 2 3 4 5 6 7 8 9 … 28 29 Next →

Figure 3. *Learning Moment* Community Feed.

RESULTS

Of the 53 medical students who completed their EM clerkship rotation, 42 (79.2%) logged at least one "learning moment." A total of 323 "learning moments" were logged between August 22, 2016 – February 12, 2017, spanning the course of six one-month-long clerkship rotations. The MS group consisted of 29 MS4s and 13 MS3s. Over half (52.4%) intended to enter the field of EM while the remainder were either undecided or intended to train in another specialty (Table 1).

The median number of "learning moments" logged by these students was six (interquartile ratio=7.5). Nearly 40% (n=16) of the students logged 1-4 "learning moments," and over 25% (n=11) logged 5-8 "learning moments" (Figure 4).

A total of 266 "learning moments" included optional location data. The most frequently reported location was patient rooms (135 "learning moments," 50.8%). Physician workstations hosted the second most frequent "learning moments" (67, 25.2%) (Table 2).

The distribution of reported locations of "learning moments" differed between EM-bound and non EM-bound students. EM-bound students reported 43.7% of "learning moments" happening in patient rooms, followed by workstations (32.8%), hallways (14.8), and resuscitation rooms (8.2%). On the other hand, non EM-bound reported 66.3% of "learning moments" having occurred in patient rooms and only 8.4% at workstations ($p<0.001$).

Table 1. Characteristics of medical students who participated in *Learning Moment*.

Characteristics	N=42
Training level, n (%)	
MS4	29 (69.0)
MS3	13 (31.0)
Intended specialty, n (%)	
EM	22 (52.4)
Other/undecided	20 (47.6)
Logged "learning moment" per student, median (IQR)	6 (7.5)

EM, emergency medicine, *MS*, medical student.

Differences were also seen in the distribution of "learning moment" location between MS3s and MS4s. MS3s logged 41 (68.3%) "learning moments" happening in patient rooms with the remainder evenly divided between workstations, hallways, and resuscitation rooms. MS4s logged relatively fewer, 94 (45.6%), "learning moments" happening in patient rooms and more, 61 (29.6%), happening at the workstations ($p=0.005$).

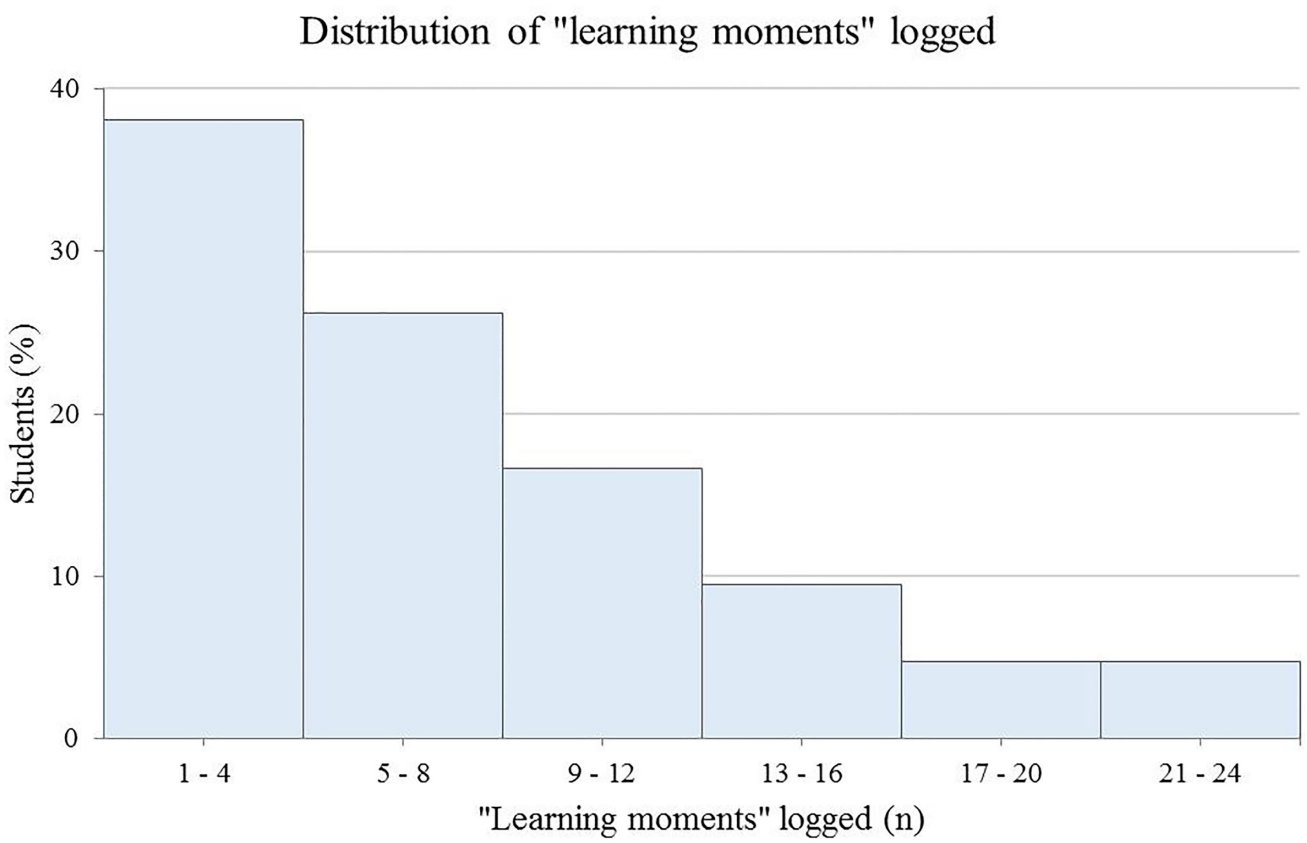

Figure 4. Distribution of number of "learning moments" logged by students.

DISCUSSION

LM is a novel educational platform designed to integrate experiential learning and shared learning. We employed the LM platform to track the location of "learning moments" as a proxy to gain insight into the location of experiential learning in a busy ED. Our data suggest that the majority of "learning moments" occur at the patient bedside, despite our hypothesis to the contrary. By hypothesizing that the majority of "learning moments" on LM would occur away from the bedside, where faculty-learner interactions have been shown to be low,[5] we may have overemphasized the importance of faculty-student interactions in the learning process. Our results are consistent with Kolb's notion that the learning is happening everywhere at all times.[1] In fact, we demonstrated that the majority of "learning moments" were happening without the presence of faculty, but from patient interactions instead.

The decline of bedside teaching and the pressures and barriers influencing it have been well-described.[3] The findings presented here, however, suggest that it remains an important component of undergraduate medical education. Educators may need to develop new strategies to continue to provide opportunities for bedside teaching for our learners. In addition to existing strategies described in the literature,[3,8] one potential approach already employed at various institutions is to provide dedicated time for faculty teaching shifts or senior resident teaching rotations where education is prioritized over clinical flow and productivity. Increased faculty coverage in the ED may potentially encourage increased time spent directly interacting with learners, especially at the bedside. Furthermore, both resources and time for faculty to attend teach-the-teacher programs would better prepare clinicians to be competent educators in order to maximize bedside teaching opportunities that currently exist. Faculty incentives such as teaching awards, financial reimbursements, and promotion may further encourage bedside teaching.

The results of this study indicate that the physician workstation is the most common non-bedside location of "learning moments," especially for EM-bound students. It is likely of benefit to optimize educational experiences in this setting as well. Multiple potential strategies to teach effectively at workstations have been described in the literature.[8,9] Additional ways to take advantage of learning interactions at the workstation include making available a collection of cases, images, electrocardiograms etc. on a shared drive for when teachable moments arise. Students often use online resources to answer questions during clinical

Table 2. Location of "learning moments" by intended specialty and training level (n=266).

		Intended specialty[1]		Training level[2]	
Location	Total (%)	EM	Other/undecided	MS4	MS3
Hallway	39 (14.7)	25 (13.7)	14 (16.9)	33 (16.0)	6 (10.0)
Pharmacy	1 (0.4)	1 (0.6)	0 (0.0)	1 (0.5)	0 (0.0)
Patient room	135 (50.8)	80 (43.7)	55 (66.3)	94 (45.6)	41 (68.3)
Resuscitation hallway	2 (0.8)	2 (1.1)	0 (0.0)	2 (1.0)	0 (0.0)
Resuscitation room	22 (8.3)	15 (8.2)	7 (8.4)	15 (7.3)	7 (11.7)
Workstation	67 (25.2)	60 (32.8)	7 (8.4)	61 (29.6)	6 (10.0)

EM, emergency medicine, *MS*, medical student.
[1]Fisher's exact p-value<0.001; [2]Fisher's exact p-value=0.005

work. It is essential to provide links to reliable resources for evidence-based medicine, clinical guidelines, and clinical decision-rules. At the same time, medical schools should continue to train students to be thoughtful and efficient curators and interpreters of literature. Interventions to optimize experiential learning at the bedside and at the workstation could potentially be directly evaluated using LM to see if more "learning moments" are logged as a result.

Interestingly, EM-bound students reported notably fewer "learning moments" occurring in patient rooms and more occurring at the workstations than their non EM-bound colleagues. These findings raise the question: Are there inherent differences between the learning preferences of EM-bound students vs. non EM-bound students? Considering that aversion to bedside rounding is commonplace among EM residents, one could postulate that those who choose EM as their intended specialty may have an increased propensity to learn "on the spot," such as at the workstations where presentations of cases commonly occur. It is conceivable that EM-bound students may preferentially receive more teaching from residents and faculty who are aware of their learners' decision to enter EM. The shift in location of "learning moments" from bedside to workstations from the MS3 to MS4 year may represent changing learning preferences as students progress along the spectrum from novice to expert learners, or may simply be the result of a large proportion of rotating MS4s who chose EM as their intended specialty compared to mostly undecided MS3s (Table 1). It would be valuable to conduct a similar study in EM resident populations to see if the results differ; such insight could potentially benefit graduate medical education training.

LIMITATIONS

Our study has several limitations. We emphasized during orientation and registration to LM that the "location" drop-down menu when logging a "learning moment" on the website was meant to indicate the location of where the "learning moment" occurred, not the location of the patient. Students may still have mistakenly chosen the patient's room number when they logged some "learning moments." Doing so would have falsely elevated the number of "learning moments" documented in patient rooms. Furthermore, out of 323 total "learning moments", only 266 contained the optional location data. Our study is limited by the use of learner self-selected learning experiences in the form of "learning moments" as an imperfect proxy to gain insight to the location of experiential learning in the ED environment. No direct observation of where learning was happening was performed. Recall bias is a significant confounder to our data as we intentionally left it up to the students to choose what learning experiences to log as a "learning moment." Certain experiences may be overlooked when learners fail to consciously notice that learning is happening. They may also choose to document certain types of learning experiences over others. Lastly, our pilot was conducted at a single department within one institution. Other learning environments may yield different results. Nevertheless, data from LM has the potential to help educators better understand the intricacies of local learning microenvironments as well as the broader clinical learning ecosystem.

CONCLUSION

LM was implemented within our ED as an innovative, web-based tool to fulfill and optimize the experiential learning cycle for our learners. In our environment, patient rooms represented the most frequent location of "learning moments," followed by physician workstations. EM-bound students were considerably more likely to document "learning moments" occurring at the workstation and less likely in patient rooms than their non EM-bound colleagues. Although successfully piloted in the ED, LM is potentially adaptable to other clinical departments and institutions as we seek to inform the design of optimal learning ecosystems and maximize experiential learning for all future trainees. Efforts are ongoing to make LM available to more learner populations in new learning environments as we continue to demonstrate the feasibility and value of our platform to various stakeholders throughout health professions education.

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The National Clinical Assessment Tool for Medical Students in the Emergency Department (NCAT-EM)

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Introduction: Clinical assessment of medical students in emergency medicine (EM) clerkships is a highly variable process that presents unique challenges and opportunities. Currently, clerkship directors use institution-specific tools with unproven validity and reliability that may or may not address competencies valued most highly in the EM setting. Standardization of assessment practices and development of a common, valid, specialty-specific tool would benefit EM educators and students.

Methods: A two-day national consensus conference was held in March 2016 in the Clerkship Directors in Emergency Medicine (CDEM) track at the Council of Residency Directors in Emergency Medicine (CORD) Academic Assembly in Nashville, TN. The goal of this conference was to standardize assessment practices and to create a national clinical assessment tool for use in EM clerkships across the country. Conference leaders synthesized the literature, articulated major themes and questions pertinent to clinical assessment of students in EM, clarified the issues, and outlined the consensus-building process prior to consensus-building activities.

Results: The first day of the conference was dedicated to developing consensus on these key themes in clinical assessment. The second day of the conference was dedicated to discussing and voting on proposed domains to be included in the national clinical assessment tool. A modified Delphi process was initiated after the conference to reconcile questions and items that did not reach an a priori level of consensus.

Conclusion: The final tool, the National Clinical Assessment Tool for Medical Students in Emergency Medicine (NCAT-EM) is presented here. [West J Emerg Med. 2018;19(1)66-74.]

INTRODUCTION

Clinical assessment of medical students in the emergency department (ED) is a highly variable process in which emergency medicine (EM) clerkship directors (CDs) use institution-specific tools that often lack validity evidence,[1] making it impossible to reliably measure students' performance or compare students across institutions. Complicating the problem, EM is taught at multiple points in the medical school curriculum (third vs. fourth year); it may be mandatory, elective, or selective; and students seeking careers in EM typically complete clerkships at multiple different institutions.[2,3] Furthermore, some institutions use the same tool for all clerkships, regardless of specialty, an approach that fails to address the unique opportunities, challenges, and priorities inherent to the specialty of EM.[1]

Clinical assessment data is translated into grades, medical student performance evaluations (MSPE, or "dean's letters"), and the standardized letter of evaluation (SLOE), a critical element of residency application in EM.[4] The SLOE was developed as a means to discriminate between candidates, and to compare candidates across institutions.[4,5] However, each institution uses its own idiosyncratic approach to collecting, analyzing, and interpreting assessment data, which are derived from highly variable institutional tools that may or may not address the knowledge, skills, and attributes most valued in the EM setting. Grades and SLOEs are key determinants of residency placement, and may dictate whether a student matches into EM at all.[4] It is thus imperative to ensure the reliability and validity of the assessment process in the interest of students and residency programs alike.

Adoption of a common, specialty-specific assessment tool and standardization of assessment practices across institutions would permit EM CDs to better measure student performance, improve the quality of formative feedback, monitor student progression over time, and compare students across institutions during the residency application process. To this end, a national consensus conference on clinical assessment of medical students in EM clerkships was held in the Clerkship Directors in Emergency Medicine (CDEM) track of the Council of Emergency Medicine Residency Directors (CORD) Academic Assembly in Nashville, TN, in March 2016. The goal of this conference was to develop a standardized clinical assessment tool and guidelines for its use in EM clerkships, based on expert consensus among a national group of EM educators.

METHODS

Pre-conference Work

Themes of Assessment

Prior to the conference, overarching "themes" surrounding the clinical assessment of medical students were derived from small-group discussions among the executive committee, and refined at a large-group planning meeting in the CDEM track at the 2015 CORD Academic Assembly in Phoenix, Arizona. The themes were not directly related to construction of the final assessment tool – instead, the goal was to clarify the philosophical underpinnings of clinical assessment in the ED, and to identify "best practices" for the acquisition and use of assessment data. The themes identified for consensus discussion were the following:

1) Criterion- vs. normative-referenced assessment
2) Assessment of learners at different levels
3) Translation of end-of-shift assessment data into other products (SLOEs, grades, MSPEs)
4) Implementation and use of assessment tools

The executive committee identified "theme leaders" one year prior to the consensus conference (Table 1). Each theme leader was tasked with recruiting relevant stakeholders to their group, synthesizing the literature on their topic, and articulating key questions pertinent to their theme. Theme leaders were encouraged to participate in other themes' discussions to assure complete and non-duplicative efforts.

Domains of Assessment

In addition to the themes listed above, the executive committee developed a list of potential assessment domains to be considered for inclusion in the assessment tool itself. For each domain, the executive committee drafted a document using a standard format including background information, an operational definition of the domain, a list of possible benefits, drawbacks, and alternatives to including the domain in the final assessment tool, and example items that could potentially be used to assess the domain in question. To the greatest extent possible, these documents were grounded in foundational source materials reflecting national expert consensus regarding each domain.[1,4,6-10] The purpose of these documents was to highlight key issues within each domain, to standardize items for discussion, and to facilitate rapid construction of an assessment tool based on the sample items within each domain selected for inclusion.

The conference was widely publicized to EM CDs, residency directors, deans, and non-physician educators. When participants registered for the 2016 CORD Academic Assembly, they were invited to register for the consensus conference simultaneously. One week prior to the conference, the executive committee electronically distributed preparatory materials to all registered attendees, including theme summaries, domain descriptions, and reference lists.

Consensus Conference

Day 1

The first day of the conference focused on the overarching themes in clinical assessment. Participants were divided into four small groups. Theme leaders rotated at timed intervals among each of the four groups. Small groups maximized the opportunity for each attendee to actively participate in the discussion. Attendance for each group was recorded, and scribes documented the discussion. After discussion, participants were asked to vote on key questions identified in advance by the theme leaders.

Table 1. Leadership group for CDEM National Consensus Conference on Clinical Assessment of Medical Students in the ED.

					Current/past roles				
Rank	Name	Degrees	Institution	Rank	CD	UME director	APD	PD	Deanship
Executive committee	Douglas Franzen	MD, MEd	University of Washington	Assistant Professor	x	x	x		x
	Katherine Hiller	MD, MPH	University of Arizona	Professor	x	x			
	Julianna Jung	MD, MEd	Johns Hopkins University	Associate Professor	x	x			
	Luan Lawson	MD, MAEd	East Carolina University	Associate Professor	x	x			x
Theme leader, criterion- vs. norm-referencing	David Manthey	MD	Wake Forest School of Medicine	Professor	x	x			x
Theme leader, learners at different levels	Marianne Haughey	MD	CUNY Medical School	Professor	x		x	x	
	Joseph House	MD	University of Michigan	Associate Professor	x	x	x		
Theme leader, translation of assessment data	Matthew Tews	DO, MS	Medical College of Georgia	Professor	x	x			x
Theme leader, use of clinical assessment tools	Nicole Dubosh	MD	Harvard Medical School	Assistant Professor	x				
	Jonathan Fisher	MD, MPH	University of Arizona (Phoenix)	Professor	x	x	x		x
Theme leader, ensuring validation and research	David Wald	DO	Lewis Katz School of Medicine	Professor	x	x			x

CDEM, Clerkship Directors in Emergency Medicine; *ED*, emergency department; *CD*, clerkship director; *APD*, associate program director; *PD*, program director; *UME,* undergraduate medical education.

Voting was tallied by paper ballot.

Day 2

The second day of the conference began with a recap and synthesis of the findings from the first day. Next, the potential domains of assessment were discussed one by one in a large group with all participants, and then participants voted electronically on these questions:

1) Should this domain be included on a national clinical assessment tool?
2) If yes, would the domain best be assessed via a narrative response, a dichotomous response, or a rating scale?
3) Should the example item for the domain be adopted as written, or should it be modified?
4) What modifications, if any, are needed for the item?

The Poll Everywhere electronic audience response system (www.polleverywhere.com) was used for voting and to obtain free-text responses for the last question. Additionally, a scribe recorded discussion within the large group. Prior to the conference, the executive committee decided a two-thirds supermajority would constitute consensus.

Post-conference Work: The Delphi Process

Following the conference, results were analyzed and reported to the theme leaders and participants. The results were additionally disseminated at the Society of Academic Emergency Medicine Annual Meeting in New Orleans in April 2016. A modified Delphi process was subsequently used to refine and finalize the work of the conference. All conference participants as well as members of CORD and CDEM were invited to participate in the Delphi group, the goals of which were the following:

1) Address unresolved differences regarding themes of assessment
2) Finalize the domains to be included on the national assessment tool
3) Refine the items used to assess each domain
4) Determine design elements for the national assessment tool.

The modified Delphi process spanned several months and included a group of 66 EM educators, including 36 CDs, seven undergraduate medical education directors, 14 assistant/associate program directors, 10 program directors, and four with deanships. The Delphi group used Qualtrics (www.qualtrics.com) to vote on

discrete questions and to provide qualitative feedback. Through an iterative process, the group achieved the two-thirds supermajority required for consensus regarding most outstanding questions. Once consensus was achieved on all questions of content, the group conducted a series of web-based teleconferences to address items that did not achieve consensus, and to finalize the wording and design elements of the assessment tool.

RESULTS

Participants

A total of 64 people participated on Day 1, including 36 CDs, 25 residency program directors and assistant/associate program directors, eight undergraduate medical education directors, and four with deanships. A total of 76 people participated on Day 2, including 55 CDs, eight residency program directors and assistant/associate program directors, four general teaching faculty, four students, three clerkship coordinators, one resident, and one cognitive psychology expert. Many participants hold more than one role but were asked to list their primary role.

Day 1

Theme 1: Criterion- vs Norm-referenced Assessment

Half of all participants (51%) favored incorporating elements of both assessment approaches; 37% preferred competency-based assessment only, and 11% preferred norm-based assessment only. This theme also included a discussion of the goals of clinical assessment in the ED. Provision of learner feedback was felt to be the most important goal of assessment by 80% of participants, with generation of grades (36%) and ranking of students for residency application (15%) coming in second and third, respectively.

Theme 2: Learners at Different Levels of Training

Participants felt that one assessment tool should be used for all student learners regardless of year of training (67.2%), and that if a clerkship takes multiple levels of students (M3, M4, etc.) all evaluator types (intern, resident, faculty, etc.) should be allowed to assess all levels of learners (91.2%). There was no consensus as to whether grading criteria should differ between third- and fourth-year students (41.4% yes, 58.6% no); but participants agreed that experience level of the student within a given year of training should not affect grading (33.3% yes, 66.7% no).

Theme 3: Translation of Clinical Assessment Data into Other Products

Participants agreed that data from a series of rating scale items used across multiple specific domains of assessment could be translated into a final rotation grade (66.7%). However, there was no consensus on whether a single global assessment item could be used independently to generate a final rotation grade (60.0% yes, 23.3% no, 16.7% unsure). There was strong consensus that clinical assessment data should be used to generate grades (83.1%), SLOEs (81.3%) and to determine clinical competency (88.1%); 71.7% agreed that clinical assessment data could and should be incorporated into the SLOE in a standardized manner for all EM-bound students.

Theme 4: Issues Around Implementation and Use of Clinical Assessment Tools

Participants agreed that a single assessment tool could be used to measure performance across multiple institutions (82.6%). There was also strong consensus that the unit of observation used for an assessment form should be a single ED shift (84.7%). When asked how many assessments would be necessary to generate a final grade, 94% of respondents indicated that more than five were needed, with two thirds of the responses falling between six and ten shifts.

Participants were unanimous that EM faculty and senior EM residents should be allowed to assess students. However, only a minority felt that assessment should be conducted by junior residents or interns (33.9%), non-physician providers (22%), or off-service residents (3%). The majority (84.7%) agreed assessors should undergo some form of training before assessing students.

Day 2

Of the 16 potential domains of assessment presented on Day 2, the group agreed to include nine (agreement 69-98%), and exclude five (agreement 74-90%). Consensus was not reached on two domains (Table 2). Importantly, the group did not feel that the excluded domains were unimportant, but that these skills were not amenable to end-of-shift or clinical assessment. For example, procedural skills may be better measured using a procedure-specific checklist during a directly observed encounter than on a global clinical assessment tool. Response rates for these polls ranged from 83-100%, with a mean response rate of 90%. The group achieved consensus regarding assessment format on all included domains (agreement 68-97%). Participants agreed that all domains should be assessed using a rating scale, with the exception of professionalism, for which a combined dichotomous/narrative format was selected. Response rates on these polls ranged from 44-99% (mean 83%) (Table 2).

The final NCAT-EM contains eight domains of assessment (see Figure). Six clinical performance domains are measured using a four-point rating scale based on the Association of American Medical Colleges core Entrustable Professional Activities (EPA) and the EM Milestones.[6,11] Professionalism is measured dichotomously, with space for narrative comments when concerns are identified. A final norm-referenced global rating item requires assessors to rate the student relative to other students. The tool is designed for both paper-based and electronic formats. While it is intended to be a comprehensive assessment of the clinical performance of students in the emergency department, it is also intended to be only one element of a comprehensive evaluation of a student's performance on an EM clerkship. Data

Table 2. Consensus regarding domains of assessment to include on a national end-of-shift assessment form in emergency medicine.

	Number voting	Agreement
Domains to include		
Ability to generate a prioritized differential diagnosis	64	98%
Format: rating scale	59	97%
Ability to formulate a management plan	61	97%
Format: rating scale	56	96%
Professionalism	58	97%
Format: combined dichotomous/narrative	65	88%
Global assessment	62	93%
Format: rating scale	59	86%
Format for rating scale: entrustability*	68	51%
Patient-centered communication*	58	83%
Format: rating scale	53	81%
Focused history and physical exam skills	66	77%
Format: rating scale	67	70%
Observation, monitoring and follow-up	64	75%
Format: rating scale	65	68%
Team-centered communication*	62	73%
Format: rating scale	31	87%
Emergency recognition and management	68	69%
Format: rating scale	69	70%
Domains not to include		
Resource utilization, ordering tests/consultation	67	90%
Problem-based learning and improvement	56	89%
Medical documentation	63	83%
Disposition	65	78%
Procedures	58	74%
No consensus		
Multitasking/task switching	71	62%
Medical knowledge	61	57%

from this tool should be used in concert with other assessment methods such as written exams, objective structured clinical examinations, direct observation sessions, presentations or projects, etc. when calculating a final grade.

Consensus guidelines for use of the NCAT-EM based on the results of Day 1 were these:

1) Faculty and senior EM residents should be the primary users of this tool
2) Assessors should undergo training prior to using the tool for assessment
3) The form should be used to assess performance on a single ED shift
4) No fewer than six independent assessments should be completed to translate the data into a grade
5) The tool may be used for all learner levels in the ED
6) Data from the form can be used to contribute to grades, SLOEs, and determination of competency.

DISCUSSION

Based on the variability of current clinical assessment tools and practices, we anticipated large variability in opinion on the topics presented. However, we were surprised by the amount and strength of consensus on most topics, which likely reflects recognition among participants of the inadequacy of current assessment processes, and a desire to improve reliability, validity, and standardization across institutions. Overall, participants agreed on a large number of the themes and domains of assessment presented.

Student Name:	Date:
Assessor Name:	Shift/site:

	Pre-Entrustable	**Mostly Entrustable**	**Fully Entrustable/ Milestone 1**	**Outstanding/ Milestone 2**
Focused history and physical exam skills □ Unable to assess	Extraneous or insufficient information. May miss key physical findings or examine incorrectly.	Generally adequate information. Exam mostly adequate and correct. May not differentiate important from extraneous detail.	Appropriate information for clinical context. Exam complete and appropriately tailored. May include excess detail, but thorough and accurate.	Exceptional focused H&P, obtains all relevant information. Addresses chief complaint and urgent issues. Differentiates important from extraneous detail.
Ability to generate a prioritized differential diagnosis □ Unable to assess	Limited ability to filter, prioritize, and connect information to generate a basic differential based on clinical data and medical knowledge.	Generally able to filter and connect information to generate a basic differential based on clinical data and medical knowledge. Beginning to incorporate data and prioritize.	Reliably synthesizes data into a complete differential. Incorporates data. Prioritizes differential by likelihood.	Demonstrates exceptional differential diagnosis and data interpretation. Uses all available information to develop a prioritized differential focusing on life/limb threats.
Ability to formulate plan (diagnostic, therapeutic, disposition) □ Unable to assess	Difficulty applying knowledge to formulate plans, or does not offer plan.	Usually able to apply knowledge to formulate plans, though plans may be incomplete/incorrect in some details.	Reliably able to apply knowledge to formulate plans that are complete, appropriate, and tailored to patient needs/desires.	Exceptional ability to apply knowledge to formulate outstanding patient-centered plans.
Observation, monitoring and follow-up □ Unable to assess	May not re-evaluate patients or follow up results in a timely fashion.	Usually re-evaluates patients and follows up results, though may need prompting. Beginning to integrate new data into ongoing plan.	Reliably re-evaluates patients and follows up results in a timely manner without prompting. Integrates basic data into ongoing plan, though may need help. Completes tasks despite distraction.	Exceptional re-evaluation and follow up skills. Proactive. Integrates complex results into ongoing plan. Able to handle multiple patients simultaneously.
Emergency recognition and management □ Unable to assess	May not recognize or respond to abnormal vital signs or patient deterioration. Delays or fails to seek help. Unable to recommend stabilization interventions.	Recognizes and responds to most abnormal vital signs but may miss subtle changes. Promptly seeks help. Recommends and/or initiates some basic stabilization interventions.	Reliably recognizes and responds to all vital sign abnormalities and trends. Promptly seeks help. Recommends and/or initiates all basic and some advanced stabilization interventions.	Exceptionally attentive to vital sign abnormalities and patient deterioration. Promptly seeks help. Recommends and/or initiates basic and advanced interventions appropriately.

Figure. Clerkship Directors in Emergency Medicine National Clinical Assessment Tool.

	Pre-Entrustable	Mostly Entrustable	Fully Entrustable/ Milestone 1	Outstanding/ Milestone 2
Patient- and team-centered communication ☐ Unable to assess	Communication with patients and/or team is unidirectional or not tailored to circumstances. May not read or respond to others' emotions well. May not always attend to patient comfort or preferences. May not always integrate well into team, may not recognize value of team contributions.	Communication with patients and/or team is bidirectional and usually tailored to circumstances. Generally reads and responds to others' emotions well. Usually attentive to patient comfort and preferences. Usually integrates well into team, may not fully understand team roles or contributions.	Communication with patients and/or team is bidirectional and reliably tailored to circumstances. Skillful in reading and responding to others' emotions. Reliably sensitive to patient perspective and preferences. Integrates well into team and recognizes value of team members.	Demonstrates exceptional communication skills with patients and/or team. Effectively reads and negotiates complex emotional situations and conflicts. Always sensitive to patient perspective. Highly regarded by patients and team

Professionalism: Specific Attribute/Behavior	**Concerns?**		**Please describe specific behaviors observed**
	Yes	**No**	
Compassion, sensitivity, or respect towards patients			
Respect or collegiality towards team members			
Receptivity to constructive feedback			
Honesty or ethical conduct			
Dependability, accountability, or responsibility			
Initiative, diligence, or work ethic			
Punctuality, attendance, or preparation for duty			
Appropriate dress or grooming			
Other (please describe)			

Global assessment: compared to other students with a similar level of experience, this student's performance today was:

Lower 1/3	Middle 1/3	Top 1/3	Exceptional (top 10%)

Please comment on this student's performance today:

Figure. Continued.

There were several pedagogical issues that arose during the consensus conference and post-conference Delphi process. While it is possible to assess medical knowledge with a clinical assessment tool, participants felt that it was much more important to assess the *application* of medical knowledge clinically. This was considered and voted on as a stand-alone domain of assessment, but the group agreed to exclude application of medical knowledge as its own domain as participants felt it was best incorporated into other domains (ability to generate a differential diagnosis, ability to generate a management plan, etc.). As a result, the application of medical knowledge is included in the anchors for multiple domains.

Qualitative input from participants strongly supported keeping the assessment tool as concise as possible to improve usability and response rate. To that end, post-conference work included discussion on whether to combine "Ability to Generate a Focused Differential Diagnosis" with "Ability to Generate a Management Plan," and "Patient-centered Communication" with "Team-centered Communication." The Delphi group did not reach a high level of consensus on either of these topics. Ultimately, the group decided to retain "Ability to Generate a Focused Differential Diagnosis" and "Ability to Generate a Management Plan" as unique domains of assessment, and to combine "Patient-centered Communication" with "Team-centered Communication," while all other domains were retained as unique items on the assessment tool.

Another important conversation in the post-conference work was the reconciliation of the majority opinion during the conference to include elements of both peer-referenced and criterion-referenced assessment on the final form with the lack of consensus surrounding how best to frame a global assessment. This final element of the NCAT-EM was ultimately included as a peer-referenced element in order to provide at least one norm-referenced element of assessment.

Finally, professionalism is a domain of assessment for which a comprehensive, yet specific, assessment was problematic. "Professionalism" itself is a large, heterogeneous set of attributes ranging from punctuality to honesty to responsiveness to feedback. The NCAT-EM contains seven distinct professionalism attributes and an "other" category. This domain asks the assessor to identify whether there are concerns regarding any of the sub-domains, and if so, to describe them. This format implies that students by default exhibit professionalism unless otherwise noted. The group also felt that within each sub-domain, professionalism is an "all or nothing" proposition, and that any lapse merits serious consideration.

LIMITATIONS

There were several limitations to this study. First, although widely publicized the conference was only attended by approximately one third of the CDEM Academy membership. Not all clerkship directors belong to the CDEM Academy or attend the CORD Academic Assembly, potentially biasing the results. However, it is likely that the educators who did participate are among the most engaged of the community with respect to clinical assessment of students in EM clerkships. Additionally, though they were not counted in the analysis and did not participate the day of the conference, many of the members of the theme groups were heavily involved in the preparation of the discussion. Residency leaders, non-physician educators, administrative professionals, students and other stakeholders were represented; however, it is unclear what the ideal ratio of participants may be. As this was a convenience sample, it may be that some minority groups were over- or under-represented.

Voting on the potential domains of assessment on Day 2 may have been affected by the order of presentation. Participants may have been more comfortable with the format and process after voting on the first few. Additionally, they may have been more apt to comment once they had a better understanding of the bigger picture and how the source materials were referenced. We attempted to mitigate this by providing the materials to participants beforehand and providing preparatory lectures to frame the questions and discussion at the beginning of both days of the conference. Finally, participants were able to change their vote as long as a poll was open. This affected the final results of some of the proposed domains as comments during the group discussion swayed votes. While this may be seen as a limitation in the study design, we feel this resulted in better representation of the group's consensus.

CONCLUSION

The NCAT-EM is the first national, standardized, consensus-derived, specialty-specific clinical assessment tool. The conference and the subsequent Delphi process leading to the development of this tool represent critical first steps in the development of national guidelines and a standardized approach to clinical assessment in undergraduate medical education. However, development of an assessment tool is only the first step. Critical next steps include measuring how the tool performs, comparison of the tool to existing assessments, development of training materials, and determination of how to implement its use.

Standardization of assessment practices across institutions will facilitate rigorous study of the reliability and validity of the tool itself, as well as enabling meaningful comparison of students across clerkships and institutions. The process of synthesizing the source data and seeking feedback from current clerkship directors could be emulated by other specialties, using their own specialty-specific source material, clinical priorities, and expert input. This may promote improved assessment of learners in other fields. While creation of a common assessment tool and guidelines were the primary objectives of our project, there was also an educational benefit for participants, who learned about current literature and best practices related to

assessment, thus elevating the level of conversation around assessment in our specialty. Historically, clinical education research has been stymied by a lack of consistent assessment strategies and tools. Moving forward, the NCAT-EM has the potential to greatly improve educational research in EM, as well as improving the quality of learner assessment for the benefit of learners, educators, and ultimately patients.

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Tit-For-Tat Strategy for Increasing Medical Student Evaluation Response Rates

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Introducation: It is essential for faculty to receive feedback on their teaching for the purpose of improvement as well as promotion. It can be challenging to motivate students to provide feedback to preceptors and fill out evaluation forms when not a clerkship requirement. Furthermore, there is concern that making the evaluations a requirement can compromise the quality of the feedback. The objective of this study was to identify an increase in the number of faculty and resident evaluations completed by students rotating through their Emergency Medicine clerkship following the implementation of a tit-for-tat incentive strategy.

Method: Prior to the implementation of Tit-for-Tat, students rotating through their emergency medicine clerkship were asked to fill out evaluations of residents and faculty members with whom they worked. These were encouraged but voluntary. Beginning in the 2014-2015 academic year, a tit-for-tat strategy was employed whereby students had to complete a resident or faculty evaluation in order to view the student assessment completed by that resident or faculty preceptor.

Results: Students submitted 1101 evaluations in the control, with a mean of 3.60 evaluations completed per student and 3.77 evaluations received per preceptor. Following the implementation of tit-for-tat, students submitted 2736 evaluations, with a mean of 8.19 evaluations completed per student and 7.52 evaluations received per preceptor. Both the increase in evaluations completed per student and evaluations received per preceptor were statistically significant with p-value <0.001.

Conclusion: The tit-for-tat strategy significantly increased the number of evaluations submitted by students rotating through their emergency medicine clerkship. This has served as an effective tool to increase the overall number of evaluations completed, the number of evaluations each instructor received on average and the proportion of students that completed evaluations. Further work could be done to attempt to better assess the quality of the feedback from these evaluations. [West J Emerg Med. 2018;19(1)75–79.]

INTRODUCTION

Student evaluations are paramount to faculty both administratively and academically. Evaluations have been used as data to inform the decision for promotion and tenure in higher education for years.[1] By comparing data of faculty obtained through trainee evaluations, individual educator performance can be measured. Equally as important is the ability for faculty to grow as educators by internalizing feedback from evaluations; celebrating accomplishments and providing a substrate for areas in which growth is necessary.[2] Using student evaluations in this way employs the social constructivist model; faculty use feedback from students for professional development and

reflective improvement. Knowledge and behavior are built through interaction and feedback from others.[3]

Online evaluations have become an increasingly popular method of obtaining evaluation data.[4] Previous work has identified significant advantages to the online evaluation model, which include potentially significant cost savings, improved turnaround time, greater elaboration afforded by typed responses and convenience for students to respond without using valuable class time.[5,6] In addition, online evaluations are often the preferred method by students.[7]

However, online methods of evaluation are not without disadvantage. It is well established that converting from paper evaluations to an online evaluation system results in lower response rates, which in turn can lead to increased bias and less valuable data.[8,9]

Online evaluations may be more convenient, but literature is lacking in how to motivate students and trainees to complete online evaluations. To bridge this gap, the authors tried to make the completion of evaluations a tit-for-tat situation. If the students wanted to see their evaluations during the rotation and prior to receiving their grade, they must complete an evaluation for their supervisor. In this way, the motivation comes from an internal need for feedback. The objective of this study was to identify an increase in the number of faculty and resident evaluations completed by students rotating through their Emergency Medicine clerkship following the implementation of a tit-for-tat incentive strategy. The authors hypothesize that a tit-for-tat strategy whereby students had to complete a resident or faculty evaluation in order to view their student assessment completed by their resident or faculty preceptor would increase the total number of preceptor evaluations.

Population Health Research Capsule

What do we already know about this issue?
Methods to increase online survey and evaluation response rates have been applied in the commercial and undergraduate education literatu e, but rarely studied with medical students.

What was the research question?
Does an incentive strategy increase the response rate of preceptor evaluations completed by medical students?

What was the major finding of the study?
There was an increase in evaluations completed by medical students following the implementation of an incentive strategy.

How does this improve population health?
More feedback to educators hopefully leads to better educators, educational materials and methods. Better education leads to better health care providers and healthier populations.

METHODS

This study was a retrospective cohort study of medical student evaluations of faculty and resident preceptors before and after the implementation of a tit-for-tat method to increase the number of total evaluations completed. The (blinded) Institutional Review Board approved the study.

As part of the required fourth-year Emergency Medicine clerkship at (blinded), students were asked to fill out evaluations of residents and faculty members with whom they worked. These evaluations were encouraged but voluntary. Prior to the 2014-2015 academic year, students would receive online assessments from faculty and resident preceptors. Similarly, faculty and residents would receive online evaluations from medical students with whom they worked. These evaluations of faculty and residents were blinded and aggregated so that the preceptor could not identify the medicals student.

Beginning in the 2014-2015 academic year, a tit-for-tat strategy was employed whereby each student would receive an online push notification that an assessment from a resident or attending physician had been completed and in order to view this assessment, the medical student had to complete an evaluation of the resident or attending physician in order to see the assessment of their performance. The assessment of the medical student by resident or faculty thus became un-blinded to ensure that the students knew which evaluations to complete in order to view their own assessment from the preceptor. This method was thought to not introduce bias, as the preceptor's assessment of the student could not be viewed until the student submitted the evaluation of that preceptor. Further, the evaluations completed by medical students remained blinded, such that the preceptor could not identify the medicals student evaluator. The authors could not identify any other changes in the evaluation process that would confound the results. This strategy was employed to increase the total number of resident and faculty evaluations completed by medical students.

In both the control cohort and the tit-for-tat cohort, all evaluations were submitted by three weeks after the completion of the rotation. Once the grade was assigned, 3-4 weeks after the clerkship, students could view all of their assessments of performance, as it was felt to be unfair to completely withhold feedback information.

The total number of student evaluations of both resident and faculty was recorded from 2014-16 following the implementation of tit-for-tat, as well as from 2012-2014, which was used as a

control. A Chi-squared analysis was performed to demonstrate a statistically significant increase in the number and proportion of medical students who chose to fill out evaluations. The mean number of evaluations completed per student per academic year and the mean number of evaluations received per preceptor per academic year were also calculated and compared.

RESULTS

In the control cohort, 201 of the 306 rotating medical students completed a total of 1101 of evaluations of faculty and resident preceptors. In the tit-for-tat cohort, 307 of the 334 rotating medical students completed a total of 2736 of evaluations of faculty and residents (Table 1). In the control cohort, 64.0% of rotating students completed at least one evaluation. In the tit-for-tat cohort, 91.3% of rotating students completed at least one evaluation. A Chi-squared analysis was performed and there was a statistically significant increase in student participation in completing evaluations following the implementation of tit for tat, x^2 (1) = 69.8, $p < .05$.

The mean number of evaluations completed per student was calculated from 2012-2016 to control for the variation in number of medical student rotators between academic years. An independent samples t-tests was performed to demonstrate a statistically significant increase from the control cohort to the tit-for-tat cohort. The mean number of evaluations completed per student was 3.60 (SD = 3.959) in the control cohort. The mean increased to 8.19 (SD = 3.791) evaluations completed per student in the tit-for-tat cohort, which was statistically significant with p-value <0.001. This statistically significant increase in evaluations completed per student is maintained for both faculty and residents when calculated independently (Table 2).

In addition, the mean number of evaluations received per preceptor was also calculated to control for variation in the number of resident and faculty between academic years. The mean number of evaluations received per preceptor increased from 3.77 (SD = 2.743) in the control cohort to 7.52 (SD = 5.599) evaluations per preceptor in tit-for-tat cohort, which was statistically significant with p-value <0.001. Again, this increase is maintained for both faculty and residents when calculated independently (Table 3).

DISCUSSION

The term "tit-for-tat" is an English saying dating to 1556 meaning an equivalent to an action given in return.[10] While this often carries a negative connotation, such as a blow for blow retaliation, tit-for-tat has also been used to describe positive symbiotic relationships, such as reciprocal altruism.[11] In the student-preceptor relationship, the responsibility of the preceptor is to provide feedback; likewise it is the student's role to reciprocate. Faculty evaluations are used to recognize and reward excellence as well as to identify outliers in performance and provide feedback to facilitate reflective improvement.

It is well established in the current literature that converting from paper evaluations to an online evaluation system results in lower response rates.[8] Further, it has been suggested that response rates are themselves a critical indicator of both student and faculty engagement in the course.[4] With lower response rates, the potential for error in any survey increases and in turn, the reliability of the data tends to weaken as response rates decline.[9] It has also been shown that respondents and non-respondents to evaluations differ. For instance, students are more likely to complete evaluations in courses where students have specific interest in the subject and poor performing students complete fewer evaluations.[12] As non-response rates increase, the likelihood that non-respondents' opinions differ from respondents' opinions increases.[9] Therefore, low response rates are more likely to result in bias.

Some previous work has been done on ways to increase response rates to online evaluations by using a variety of methods. These methods include teachers making a concerted

Table 1. Breakdown of evaluations by academic year.

	Total # of student rotators	# of student evaluators	#of faculty evaluated	#of residents evaluated	Total # of evaluation
Academic year					
2012-13	153	99	100	48	489
2013-14	153	102	101	42	612
2014-15	171	161	123	59	1435
2015-16	163	146	125	57	1301
Control cohort					
2012-14	306	201	201	90	1101
Tit-for-tat cohort					
2014-16	334	307	248	116	2736
2012-16	640	508	449	206	3837

Table 2. Evaluations completed per student.

	# of student rotators	Mean # of evaluations per student	Standard deviation
Faculty control	306	2.11	2.593
Faculty for tit-for-tat	334	4.85	2.621
Resident control	306	1.49	1.769
Resident tit-for-tat	334	3.34	2.244
All preceptor control	306	3.60	3.959
All preceptor tit-for-tat	334	8.19	3.791

Table 3. Evaluations received per preceptor.

	# of student rotators	Mean # of evaluations per student	Standard deviation
Faculty control	201	3.21	2.16
Faculty for tit-for-tat	248	6.53	4.924
Resident control	91	5.01	3.421
Resident tit-for-tat	116	9.63	6.345
All preceptor control	292	3.77	2.743
All preceptor tit-for-tat	364	7.52	5.599

effort to promote the online evaluation, faculty providing students with information on the use of their feedback and entering student participants in a drawing for a cash prize.[13] Small up-front gifts and conditional incentives have also been shown to increase response rates.[14] In a review article, Nulty offered a set of twelve best practices for increasing response rates to online surveys and suggests that these method are additive (table 4). While some techniques demonstrate an increase in evaluation response, they are often dependent on the enthusiasm of the faculty and response rates decline as time passes and enthusiasm wanes.[15]

While not supported by the literature, there is concern that making evaluations mandatory may affect evaluation quality. In addition, most methods that have been shown to increase response rates require input or effort by the preceptor or by an administrator. The benefit of the tit-for-tat method is it uses an automated system completely independent of additional input or effort and it accomplishes an increase in response rates through incentives. Therefore, this study supports the hypotheses that a tit-for-tat incentive strategy does increase the total number of preceptor evaluations submitted by medical students without making evaluation submission mandatory.

LIMITATIONS

Unfortunately, the evaluation system used did not track demographic data. The demographics of each study year are approximately similar to the graduating class of each academic year, but due to the presence of away rotators, the demographics cannot be calculated accurately. Differences in demographics could exist between the students in each academic year and possibly skew the results. Further, we also have no data on the number of student assessments completed by preceptors. It is unclear if there were fluctuations in the number of student assessments between academic years or what affect those fluctuations would have if they exist. During this time there were minor increases in the number of faculty and residents, it is unclear what effect this may have had. In addition, our data also shows that that average evaluation score of the emergency medicine rotation steadily increased over the course of the data collection period. It is possible that the increased popularity could have contributed to the response rates of the evaluation. As previously discussed, students are more likely to complete evaluations in subjects of personal interest. It should also be noted that this study demonstrated that the increase occurred after the intervention and concluding a causal relationships from this before and after study has limitations. Finally, the authors have no data on the quality of the evaluations. It is possible that the additional submitted evaluations differ in usefulness of comments and thus have affect the utility of the intervention.

CONCLUSION

A significantly increased in the number of evaluations submitted by students rotating through their emergency medicine clerkship was observed following the implementation

Table 4. Best practices for increasing response rates to online surveys.

1. Push the survey
2. Provide frequent reminders
3. Involve faculty in frequent emphasis of importance
4. Persuade respondents that their responses will be used
5. Provide rewards
6. Help students understand how to give constructive criticism
7. Create surveys that seek constructive criticism
8. Extend the duration of a survey's availability
9. Involve students in the choice of optional questions
10. Assure students of the anonymity of their responses
11. Familiarize students with online evaluation environment
12. Keep questionnaires brief

of the tit-for-tat method. This served as an effective tool to increase the number of evaluations completed by students and the proportion of students that completed evaluations. Further work should be done to identify any affect of the tit-for-tat method on the quality of evaluations and better understand additional methods of increasing evaluation response rates and assess if these methods are summative.

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Feasibility and Usability of Tele-interview for Medical Residency Interview

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Every year in the United States, medical students and residency programs dedicate millions of dollars to the residency matching process. On-site interviews for training positions involve tremendous financial investment, and time spent detracts from educational pursuits and clinical responsibilities. Students are usually required to fund their own travel and accommodations, adding additional financial burdens to an already costly medical education. Similarly, residency programs allocate considerable funds to interview-day meals, tours, staffing, and social events. With the rapid onslaught of innovations and advancements in the field of telecommunication, technology has become ubiquitous in the practice of medicine. Internet applications have aided our ability to deliver appropriate, evidence-based care at speeds previously unimagined. Wearable medical tech allows physicians to monitor patients from afar, and telemedicine has emerged as an economical means by which to provide care to all corners of the world. It is against this backdrop that we consider the integration of technology into the residency application process. This article aims to assess the implementation of technology in the form of web-based interviewing as a viable means by which to reduce the costs and productivity losses associated with traditional in-person interview days. [West J Emerg Med. 2018;19(1)80–86.]

INTRODUCTION

Residency interviews are an important component of the application process to U.S. graduate medical education training programs. Students apply for a residency position in their chosen specialty during the final year of medical school. This process begins with submitting a written application through the Electronic Residency Application Service (ERAS), which is then reviewed by residency program leadership who select of a subset of applicants for on-site interviews over the course of two to three months.[1] At the end of the interview period, applicants create a rank-order list of programs where they desire to train, and these lists are then submitted to the National Resident Matching Program (NRMP).[2]

The residency program and applicant's rank-order lists are highly influenced by the interview experience.[3,4] However, the traditional on-site interview process poses a significant resource burden for both applicants and residency programs. The Association of American Medical Colleges (AAMC) reported that median educational debt for medical school graduates in 2015 was over $180,000,[5] and the degree of debt influences a student's career planning.[6] According to the American Medical Association, applicants participate in an average of 12 residency interviews during their final year of medical school.[7] Often these interviews are not within close proximity to a student's home institution, thus necessitating costly travel. Concurrently, organizing multiple interview days requires substantial preparation time for residency programs. In addition to financial considerations, travel and preparation time for interviews detracts from medical education and decreases educational and clinical productivity for applicants.

To alleviate some of the financial and productivity burdens of on-site interviews, web-based residency interviews

have been proposed as an alternative.[8-10] In this article, we will review the advantages and disadvantages of web-based interviews, analyze their cost effectiveness, and discuss the effect on rank-order lists.

Advantages and Disadvantage of Web-based Interviews

Traditionally, interviews have been conducted on-site at residency programs in order to engage face-to-face with the applicant and allow them to interact with a variety of current trainees, faculty, and staff. A typical interview day often consists of presentations by program directors and/or department chairs, individual interviews by multiple faculty members, tours, and an optional social event with current residents. Hosting these activities takes considerable coordination with faculty and resident schedules and requires a sizable monetary investment from the residency program. Applicants, in turn, are responsible for financing travel and accommodations for an average of 12 interviews across the U.S.[7] while maintaining their clinical training. Advantages of web-based interviews include improved scheduling flexibility, reduction of financial burden for residency programs and applicants, and improvement of educational and clinical productivity.

Applicants most commonly decline invitations to interview due to scheduling conflicts, thus reducing the number of programs they can consider when making the rank-order list and decreasing the pool of viable applicants for the program.[8-10] Web-based interviews eliminate travel time and improve flexibility for applicants and residency programs when scheduling interviews. As such, web-based interviews offer residency programs the ability to engage and interview candidates who would otherwise not be able to participate in an on-site interview due to scheduling conflicts.

Along with improved flexibility, eliminating the need for travel also alleviates some financial burden for applicants. In March 2015 the AAMC released a report detailing the expense breakdown of applying to residency programs during the 2014-2015 application cycle.[11] The total average cost of participating in on-site interviews was $3,422.71 for each applicant. Expenses were significantly higher for applicants who participated in a couples match ($5,506.21) and for those applying to preliminary position programs ($4,575.62). Costs also varied with specialty choice, with neurosurgery residency applicants spending an average of $6,930 and family medicine applicants shouldering the lowest costs at $1,968. According to this report, 79% and 65% of the respondents strongly agreed or agreed that travel and lodging expenses, respectively, were overly burdensome. Furthermore, 58% responded that financial considerations influenced an applicant's decision to attend interviews.[11] Therefore, web-based interviews may reduce the impact of financial considerations on the decision to interview at a residency program site.

Web-based interviews may also reduce the financial burden for residency programs. Costs to programs include interview day meals, local transportation between clinical sites, written materials, and staff time dedicated to the interview day.[8] According to Shah et al. (2011), the average cost for the University of New Mexico's urology residency program to host an on-site interview was $5,031.68 for each interview process. In contrast, when a web-based interview was conducted, the financial cost of each interview process was significantly lower, averaging $2,159.40.[8]

In addition to the financial benefits of web-based interviews, educational and clinical productivity may improve. Traditional on-site residency interview days decrease time spent dedicated to educational pursuits for applicants and reduce faculty clinical hours. Applicants commit an average of 20 days to residency interviews, time therefore not devoted to medical education.[8, 12] Only 10% of applicants who participated in web-based interview missed one or more days of school, compared to 30% of applicants who participated in on-site interviews ($p = 0.04$).[8] Faculty members who practice clinically usually conduct residency interviews. Edje et al. and Tempe et al. observed that residency programs using a web-based interview process decreased the total time dedicated to interviews by seven days, thus theoretically increasing clinical work productivity of faculty members.[13,14]

Other considerations include number, length, and timing of interviews. The number and duration of interviews can be kept consistent between the two modalities. With regard to scheduling the web-based interviews, applicants can be offered the option to meet in the morning, afternoon, or evening to accommodate time zone differences.[15] Offering evening interviews allows for fewer interruptions and conflicts with daytime clinical and educational responsibilities for both applicants and faculty.[8]

Despite potential improvements in cost and productivity, some are hesitant to engage in web-based interviews due to perceived disadvantages. Common concerns include an applicant's inability to interact with current trainees and faculty.[10] Many also believe that applicants are better equipped to evaluate a city and program during an on-site interview.[10,15,16] Healy et al. reported that among the residents who interviewed for an orthopedic fellowship position via web-based interviews, some candidates felt that they either did not have the opportunity to present themselves adequately or did not feel "comfortable enough to rank the program." It was concluded that using this interview platform adversely affected the program's position on an applicant's rank list. This unfavorable outlook can negatively impact a program's ability to recruit the best applicant as well as the resident's capacity to find the best programmatic fit.[16] Conversely, one study indicated that there was no difference in the rank given to applicants by faculty, and tele-interviewing was associated with matching highly ranked applicants to their program.[16]

Although studies have shown that most interviewees were satisfied with their web-based interview experience, little research has been conducted to evaluate how video interviewing affects an applicant's rank-order list.[10,16]

Some disadvantages can be at least partially mitigated through proper planning and structuring of web-based interviews to closely mimic on-site interviews. Typically, programs prepare hard copies of information pertaining to the residency such as curriculum, clinical schedule, resident demographics, faculty biographies, research initiatives, and surrounding community.[17] These materials can be provided digitally for web-based interviewees. Similarly, presentations given by faculty and staff during on-site interview days can be replaced with recorded videos. On-site hospital tours can be substituted with interactive virtual tours of an institution's clinical sites, facilities, and surrounding geographic area.[15] Designing an accurate and informative electronic manual, videos, and tours is crucial to ensuring web-based interviewees receive sufficient information regarding the program, research opportunities, and culture. When an adult reconstruction fellowship program at Newton-Wellesley Hospital offered video tours, 83% of the web-based interviewees found the video tour helpful.[16] In addition, 85% of the candidates believed that the manual and web-based interview gave them a satisfactory and sufficient understanding of the program, though 17% still chose to visit the hospital after the interview.[16]

Opportunities to interface with current residents or faculty can be offered to web-based interviewees by providing contact information. Although interacting with current trainees was identified as an important factor to decide rank-list order,[1] only 28% of the adult reconstruction fellowship web-based interviewees contacted a current fellow.

While it is challenging to predict and minimize technological difficulties with online applications, Shah et al. established a protocol that allowed for troubleshooting well in advance of the actual interview. Their team provided written instructions for establishing a software account a month prior to the web-based interview, conducted a test call with the program coordinator to verify a successful connection during the preceding week, and offered faculty members who were unfamiliar with the technology a five-minute tutorial on the day of the interview.[8] Another potential method to minimize interruptions due to technological failures is to have a technology consultant in the room, thus allowing for immediate access to technical assistance.[16] Williams et al. also suggested that attention to small and simple details, such as sufficient lighting in the room and proper placement of the camera, made a difference in the quality of the interview.[15]

Cost Analysis of Web-based Interview

Several studies have investigated the use of technology and web-based interviews as a cost-effective alternative to an on-site interview. The need for additional staff is the most significant financial consideration for the host institution, while travel expenditures account for the greatest cost to applicants.[12] According to Kerfoot et al. (2008), lodging, food, and clothing accounted for approximately 40% of total applicant expenses, while the remaining 60% was attributed to travel alone.[12] Table 1 highlights the differences in total costs for on-site versus web-based interviews as demonstrated by several studies.

Edje et al. (2013) analyzed the financial benefits and drawbacks of web-based family medicine residency interviews compared to on-site interviews for both host institutions and applicants during the 2011-2012 application cycle.[13] According to the post-interview surveys, the cost of a web-based interview for applicants was minimal, especially if the applicant already had access to a microphone and webcam. Therefore, the total financial savings for applicants to participate in a web-based interview was $566 (95% confidence interval: $349 - $784; $p < 0.001$; $t = 5.5826$; $df = 14$; standard error of difference = 101.462).

Table 1. Cost analysis for web-based interview of residency applicants.

	Study	Residency	On-site	Web-based	Savings
Cost analysis for applicants	Edje et al. (2013)	Family medicine	-	Minimal	$566*
	Kerfoot et al. (2008)	Urology	Ave = $330/interview; Northeast: $243 Midwest: $300 West: $333 South: $368	-	-
	Shah et al (2011)	Urology	$364 ± 184 (0-800)**	$171 ± 229 (0-600)**	$193
Cost analysis for residency programs	Edje et al. (2013)***	Family medicine	$917 - $1027	$132.50	$586.40
	Shah et al. (2011)****	Urology	$5,031.68	$2,159.40	$2,872.28

*95% CI: $349 - $784; $p < 0.001$; $t = 5.5826$; $df = 14$; standard error of difference = 101.462
**$p = 0.05$
***Expenses per applicant.
****Expenses per interview day.

For residency programs, the total cost of hosting an in-state applicant was $917 compared with $1,027 for an out-of-state applicant.[13] The authors of the article did not include an expense breakdown but did indicate that the direct salary cost to interviewers was $602 for each on-site applicant. Hosting web-based interviews decreased interviewer expenses to $120 per interview. Furthermore, expenditures related to purchasing and installing the technology necessary for web-based interviews were minimal, totaling only $132.50. Therefore, the program saved approximately $586.40 for each applicant by opting to conduct web-based interviews in lieu of the traditional face-to-face format.[13]

Shah et al. also evaluated the cost effectiveness of web-based interviews compared with on-site interviews for urology residency programs during the 2010-2011 match cycle.[8] Applicants who accepted the offer to interview were randomly assigned to an on-site or web-based interview. To minimize bias in the selection process, each applicant then underwent a second interview two weeks later – those who had previously interviewed via the Internet would then repeat the process in person and vice versa. The on-site interview consisted of an eight-hour session including breakfast, an interview with the program director, six to eight additional interviews with faculty and chief residents, and a tour of two major teaching facilities. Each interview was 15 minutes long. The web-based process consisted of three to six faculty interviews that lasted approximately 15 minutes, an online tour of the facilities, and an opportunity to ask questions. In addition, there was extensive pre-interview preparation including instruction on the use of the technology a month prior to the interview and a test call to confirm proper functioning of the application.

When considering expenses, it is important to note that the average financial cost for participating in interviews is significantly affected by geography.[12] Due to the dense distribution of residency programs in the northeastern U.S, applicants from northeastern medical schools have the lowest expenses, averaging $243 per interview. In contrast, applicants from the south spend the most money at an average of $368 per interview. There have been recent advancements in scheduling technology, and some initiatives have been proposed that would allow individual programs to coordinate an applicant's interviews geographically in an effort to limit travel expenses associated with repeated trips to the same location.[18.] demonstrated that an applicant could theoretically reduce their costs significantly by using such a program, depending on the number of interviews scheduled in a specific area.[18] While such an initiative would likely provide some cost savings, the overall expenses for applicants are still decreased considerably by participating in web-based interviews by eliminating travel altogether and thus reducing expenditures associated with airfare and accommodations.

Effect on Rank-order List

Since the interview experience, interaction with residents, and academic reputation are important factors when ranking programs, the impact of web-based interviews on applicant perception of these elements must be considered.[1] As discussed previously, designing the web-based interview to closely mimic an on-site interview can potentially minimize the difference in the interview experience and the opportunity to interact with residents between on-site and web-based interviews. Subjectively, the tele-interview experience was a positive one for adult reconstruction fellowship applicants at Newton-Wellesley Hospital. Eighty-five percent of applicants believed they were able to adequately represent themselves during the web-based interview, and 81% were comfortable ranking the program.[16] That said, the study also found that 34% of interviewees believed that the web-based interview had an unfavorable impact on ranking the program.[16] The reason was not explored in the survey.

The same study also examined the effect of tele-interviewing on the program's rank list of applicants. After the web-based interview, faculty had the opportunity to meet several of their candidates in person. Neither their opinion of applicants nor rank-list order changed following a face-to-face meeting.[16] Additionally, after three years of using web-based interviews, authors reported that highly ranked applicants were matched into their program.[16] The authors of a study looking at the effect of tele-interviewing for ophthalmology resident training at the University of Arizona reported no significant differences in the number of web-based interviewees and on-site interviewees ranked in the top 25 on the program rank list.[19] The Department of Anesthesiology at Loma Linda University School of Medicine observed that the proportion of applicants accepted to residency programs was not affected by the modality of the interview.[9]

Many prior studies reported subjective data, but only a few discussed decisions on match rank list or admission rate.[9] The few studies that provide objective data are limited by small sample size and are single-center studies.[8] Therefore, the impact of web-based interviews on the ultimate decision of rank list and admission rates must be further investigated.

Applications for Web-based Interview

Another important factor when considering the merits of web-based interviewing is the reliability and usability of available programs and applications needed to facilitate the process. Several studies including Edje et al. and Vadji et al. demonstrated the successful use of free applications such as Microsoft Skype™ and Apple Facetime™.[9,13] With its widespread use (more than 74 million users exist today) and universal video-conferencing applications, Skype is a viable platform for web-based interviews. It supports group/multi-person conferencing, allowing for the applicant and each member of a panel of interviewers to be

at different locations. FaceTime boasts similar advantages but is limited in application, being available exclusively on Apple products and restricted to one-to-one video chat.[19,20] However, these programs are not without their drawbacks. Sullivan et al. found that familiarity and ease with Skype and Facetime varied depending on age, and the older generation may not have or want access to these applications.[21] Furthermore, studies have shown that there are occasional delays in both audio and video, up to 100ms, leading to disjointed calls that can negatively impact the interview process.[21]

Paid programs are also available to facilitate these interviews, such as Cisco WebEx™, which can be used for telephone or video conferencing. Minimum requirements include an account at the hosting institution, an Internet connection, and a computer with a camera (preferably 720p or better). The interviewee must have access to an email address to receive a link to join the conference. Moreover, these programs are capable of conducting tests to determine speed and connectivity prior to the interview, which will in turn affect picture and sound clarity. This and similar programs require Internet speeds of at least five megabits per second for a 720p camera or 1.3 mbps for lower resolutions. Table 2 demonstrates the minimum system requirements that would support teleconferencing programs such as WebEx.[22] The obvious disadvantage of these programs is cost, since free options do exist. However, with prices as low as $100 dollars per year, they still allow for financial savings when compared with in-person interviews.[20,22]

How to use video-conferencing programs for interviews

In order to use programs available for web-based interviews, knowledge of their functionality is essential. For programs such as WebEx™, an email sent by the host institution to the applicant will contain a link that enables the interviewee to access the platform, at which point they will be required to entire their name and email address. Four connectivity options are available including "Call me," "I will call in," "Call using computer," or "call my video system." The first two allow for audio-only conferencing. "Call me" and "Call using computer" are available if a mobile device is being used.[22] For applications such as Skype and FaceTime, all parties involved must have an account. With regard to Skype, the applicant can then add the host institution's account to his contact list, and either party can initiate a call. With group calls or panel interviews, up to six participants form a group on the application, and then the entire group is connected simultaneously using the video call button.[23]

An iOS device such as an iPhone, iPad, or Mac computer is required for the FaceTime application. If an iPhone or iPad is used, an Apple ID account is required, and the participant must be signed in at the time of use. When accessing the application via a Mac computer, FaceTime can be used without signing into an account. The email address or phone number of the party being called is then entered in manually, and the call can be initiated.[10] There are also various free applications such as Viber, WhatsApp, Telegram, and imo that could run on Android or Apple products.

DISCUSSION

While interviews are an integral part of creating the rank list for both applicants and residency programs, traditional on-site interviews can involve significant scheduling conflicts, financial burden, and reduced productivity. Some of these challenges may be alleviated when using a web-based approach to interviewing.

Advancement in high-speed Internet and technology has revolutionized communication, productivity, and efficiency. Furthermore, technology continues to enable the growth of new and innovative ways to practice medicine. Telemedicine increases access and convenience and reduces the cost of healthcare delivery.[24] Videoconferencing is frequently used in graduate and continuing medical education.[25,26] The AAMC has recently introduced a resource guide for standardized video interview operational

Table 2. Basic requirement for online access[20] to conduct web-based interviews.

	Windows	Mac OS X
Operating system	Windows 7 and above (32 bit/64 bit)	10.7 and above
Processor	Intel Core2 Dup CPU 2.XXGhz or AMD processor with 2 GB of RAM recommended	Interlude (512 MG of RAM or more)
Browsers		
Safari		5-8
Firefox	50.0 (* the 64 bit is not supported)	50.0
Internet Explorer	7 and up	

pilot, discussing how to register, interview policies, rules to protect interview integrity, and post-interview procedures.[27]

Before web-based interviews are incorporated universally as an efficient alternative to on-site interviews, additional studies must evaluate the potential risk to students whose web-based interview may impose a bias that could be eliminated in person. For example, some applicants' home environments may not be appropriate for a professional interview. Additionally, students may not have access to the advanced technology required for these Internet applications. Medical schools can consider creating interview rooms on campus in order to standardize the virtual interview experience for their students. Furthermore, studies should explore whether students of various geographic regions, ethnicities, or socioeconomic groups are more or less likely to participate in a web-based interview and the subsequent impact on rank-order lists and matching rates.

CONCLUSION

In summary, web-based interviews are cost effective for applicants and residency programs. They reduce scheduling conflicts, thus potentially increasing the qualified applicant pool, and they decrease interruptions to educational pursuits and clinical responsibilities. Both financial considerations and time constraints pose significant challenges for applicants and residency programs when accommodating on-site interviews. While the actual cost savings may differ depending on specialty, structure of interviews, geographic location, and the number of applicants, web-based interviews have been shown to be cost-effective compared to traditional practices. More studies should be done to further evaluate the viability of Internet interviews as an alternative option.

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Training in Emergency Obstetrics: A Needs Assessment of U.S. Emergency Medicine Program Directors

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Introduction: Obstetrical emergencies are a high-risk yet infrequent occurrence in the emergency department. While U.S. emergency medicine (EM) residency graduates are required to perform 10 low-risk normal spontaneous vaginal deliveries, little is known about how residencies prepare residents to manage obstetrical emergencies. We sought to profile the current obstetrical training curricula through a survey of U.S. training programs.

Methods: We sent a web-based survey covering the four most common obstetrical emergencies (pre-eclampsia/eclampsia, postpartum hemorrhage (PPH), shoulder dystocia, and breech presentation) through email invitations to all program directors (PD) of U.S. EM residency programs. The survey focused on curricular details as well as the comfort level of the PDs in the preparation of their graduating residents to treat obstetrical emergencies and normal vaginal deliveries.

Results: Our survey had a 55% return rate (n=105/191). Of the residencies responding, 75% were in the academic setting, 20.2% community, 65% urban, and 29.8% suburban, and the obstetrical curricula were 2-4 weeks long occurring in post-graduate year one. The most common teaching method was didactics (84.1-98.1%), followed by oral cases for pre-eclampsia (48%) and PPH (37.2%), and homemade simulation for shoulder dystocia (37.5%) and breech delivery (33.3%). The PDs' comfort about residency graduate skills was highest for normal spontaneous vaginal delivery, pre-eclampsia, and PPH. PDs were not as comfortable about their graduates' skill in handling shoulder dystocia or breech delivery.

Conclusion: Our survey found that PDs are less comfortable in their graduates' ability to perform non-routine emergency obstetrical procedures. [West J Emerg Med. 2018;19(1)87-92.]

INTRODUCTION

Nationally, pregnancy-related conditions are the sixth most common reason for admission to the emergency department (ED) and the fourth most common final diagnosis from the ED for women of childbearing age.[1] Pregnant women often present to the ED because they feel they are having an emergency.[2] Being able to manage both emergent and non-emergent pregnancies is a hallmark of an emergency physician (EP).[2] Currently there are no formal standardized teaching requirements beyond the minimum mandatory requirement of 10 low-risk, normal spontaneous vaginal deliveries[3] (NSVD) and the assumption that obstetrical knowledge is a core principle of emergency medicine (EM), which means that EPs must achieve this knowledge in order to practice after residency.[3,4]

Obstetrical emergencies in emergency medicine (EM) are high risk for both the practitioner as well as the patient since it is one of the leading causes of maternal mortality.[5] There is little evidence on malpractice claims related to deliveries performed in the ED; however, both obstetrics and EM are recognized as higher- risk specialties.[6,7] Likewise, there is scant data about the rate and types of obstetrical emergencies that a recent EM graduate is likely to face. The few published studies are old and may not be representative of the current landscape.[8,9] Recently it has been shown that current EM residents feel unprepared for management of these emergencies once they leave residency.[10]

The current Accreditation Council for Graduate Medical Education (ACGME) Review Committee for EM requires residents to demonstrate competency in key procedures, which includes vaginal deliveries. Residents are required to complete 10 low-risk NSVDs.[3] In addition, the 2016 *Model of the Clinical Practice of Emergency Medicine* includes both normal pregnancy as well as complications of pregnancy, and labor and delivery and the postpartum period as a part of the core content of EM.[4] As there have been no studies to date evaluating the incidence of either NSVD or complications of labor and delivery in EDs,[2] it is not clear whether current requirements adequately prepare residents for independent practice in these areas.

Little is known about the current methods being used to teach EM residents about obstetrical and gynecologic emergencies. Anecdotal reports suggest that most use a combination of didactics and simulation. Simulation-based medical education (SBME) has been shown to be beneficial in many aspects of medical education.[11-15] Likewise, the use of simulation has proven beneficial in teaching obstetrics/gynecology residents and family medicine residents the necessary skills to manage obstetrical emergencies.[5] We sought to profile the present obstetric training curricula in U.S. EM residency programs through a survey of residency program directors (PD).

METHODS

We developed a survey instrument (Table 1) based on a review of the literature on obstetrical emergencies.[2,5,8-10] To keep the survey brief, we limited our inquiry to the four most common obstetrical emergencies based on author opinion: pre-eclampsia/eclampsia, postpartum hemorrhage (PPH), shoulder dystocia, and breech presentation. We felt that these four emergencies were the most commonly encountered obstetric pathologies in the ED and the most relevant to practicing EPs.

While participants were queried about program demographics, they were not asked any questions that would identify their program. We queried PDs about the allocation of curriculum time for obstetrical training, and the teaching methods used with the four most common obstetrical emergencies named above. Ultimately, the PDs were asked to rate their level of comfort with their graduating residents' competence in managing these four obstetrical emergencies as well as their competence in performing a NSVD. Response options were four-point Likert-type scales where 1 = "very uncomfortable," 2 = "uncomfortable," 3 = "comfortable," and 4 = "very comfortable."

The survey was piloted by multiple associate program directors (APD) at each of the authors' home institutions prior to distribution. Results of the pilot suggested minor changes for clarity and readability, which were incorporated into the final survey. We chose APDs to pilot so as not to bias the responses by having subjects answer multiple similar surveys. PD contact information was captured through the ACGME and FRIEDA Online® databases.[16,17] Using REDCap,[18] an electronic data collection tool, we distributed the survey anonymously to the PDs of all U.S. EM residency programs accredited by the ACGME. In November 2016, we sent an invitation email with a link to the online survey to the 191 PDs. We sent follow-up reminders once a week for three weeks. The study received institutional review board (IRB) approval by the University of Alabama at Birmingham. We compiled and analyzed data with Microsoft® Excel.[19]

RESULTS

We received 105 responses from 191 PDs who were sent the survey (55% return rate). Table 2 provides the characteristics of the responders. We found that of the directors surveyed, most were in academic and urban settings with a 2-4 week rotation in the PGY1 year. The most common teaching modalities (Figure) used for all types of obstetrical complications were didactics (84.1-98.1%). Oral cases were the second most common teaching method for pre-eclampsia (48%) and PPH (37.2%), while homemade simulation cases were the second most common teaching method for shoulder dystocia (37.5%) and breech delivery (33.3%). The PDs' level of comfort (Figure) with their residency graduates was highest

Table 1. Survey instrument based on the most common obstetrical emergencies.

- What type of EM training program do you direct? PGY1-3 / PGY1-4
- Which of the following best describes the residential setting of your residency program?
  rural / urban / suburban
- Which of the following best describes the healthcare setting of your residency program?
  academic / community / other
- Briefly describe the healthcare setting (open question)
- How many weeks are residents required to train during their OB/GYN rotation?
  PGY1 0 / 1 / 2 / 3 / 4 / >5
  PGY2 0 / 1 / 2 / 3 / 4 / >5
  PGY3 0 / 1 / 2 / 3 / 4 / >5
  PGY4 0 / 1 / 2 / 3 / 4 / >5
- Select the methods used to train your residents to treat the OB complications and difficult deliveries listed below (select all that apply).

Pre-eclampsia/ eclampsia	Didactic/video/oral case/home sim/commercial sim/ALSO*
Post-partum hemorrhage	Didactic/video/oral case/home sim/commercial sim/ALSO*
Shoulder dystocia	Didactic/video/oral case/home sim/commercial sim/ALSO*
Breech presentation	Didactic/video/oral case/home sim/commercial sim/ALSO*

- How comfortable are you in your graduating residents' ability to take care of the following OB emergencies?

Pre-eclampsia/eclampsia	Very uncomfortable/uncomfortable/comfortable/very comfortable
Post-partum hemorrhage	Very uncomfortable/uncomfortable/comfortable/very comfortable
Shoulder dystocia	Very uncomfortable/uncomfortable/comfortable/very comfortable
Breech presentation	Very uncomfortable/uncomfortable/comfortable/very comfortable
Normal vaginal delivery	Very uncomfortable/uncomfortable/comfortable/very comfortable

ALSO, Advanced Life Support of Obstetrics; *OB*, obstetrics, *GYN* gynaecology, *PGY,* post-graduate year; *Sim,* simulation.

for NSVD, followed by pre-eclampsia and PPH. They were least comfortable with their graduates' management of shoulder dystocia or breech delivery.

DISCUSSION

To satisfy the requirement for 10 NSVDs, most of the EM programs we surveyed require residents to spend as few as two but as many as four weeks on an OB rotation during the PGY-1 year. PDs were comfortable with their residency graduates' competence in managing NSVDs, pre-eclampsia/ eclampsia, and PPH. However, they were not comfortable with their graduates' competence in managing shoulder dystocia or breech deliveries. Anecdotal accounts report that these procedures are rare in the clinical environment.

Prior research has focused on residents,[10] whereas our research focused on the perceived comfort levels of PDs. PDs were our focus as we felt that they would have the best understanding of their program's curriculum. Future opportunities include surveying recent residency graduates to assess their actual comfort level with obstetric emergencies in clinical practice.

The predominant method for teaching labor and delivery complications are didactic sessions, with a small percentage using oral board cases and homemade simulation models. The findings of this survey indicate that although there is some variability in educational methods, most programs are using the same instructional methods for teaching obstetrical emergencies. Yet PDs are not comfortable with their graduates' competence in managing two of the most complicated emergencies: shoulder dystocia and breech deliveries. Additional research is needed to better understand EM residency graduates' experiences in treating obstetrical emergencies during their independent practice as well as their perceived competence in those areas. These results suggest that more rigorous teaching methods are needed to prepare residents for these uncommon yet serious obstetrical emergencies. They may also suggest the need for more rigorous program training requirements.

When assessing the PDs' level of comfort with their graduating residents' ability to treat obstetrical emergencies, our survey addressed only five conditions that we judged were the most important. Further research must be performed to establish whether our determination was accurate, or if other obstetrical emergencies, such as third trimester bleeding, perimortem cesarean section, and proficiency in performing an episiotomy, should be evaluated.

Table 2. Characteristics of EM program directors who responded to survey regarding obstetrics/gynecology curriculum.

Characteristics of survey responders	% (n)
Residency program duration	
3 Years	71.4 (75)
4 Years	28.6 (30)
Program location	
Urban	65.4 (68)
Suburban	29.8 (31)
Rural	4.8 (5)
Healthcare setting	
Academic	75.0 (78)
Community	20.2 (21)
Other	4.8 (5)
Timing of OB/GYN rotation in curriculum	
PGY 1	84.9 (90)
PGY 2	12.3 (13)
PGY 3	2.8 (3)
PGY 4	0 (0)
Duration of OB/GYN rotation	
1 week	0.9 (1)
2 weeks	38.0 (41)
3 weeks	18.5 (20)
4 weeks	42.6 (46)

OB, obstetrics, *GYN* gynaecology, *PGY,* post-graduate year.

The nature of some of the obstetric emergencies that we queried, namely pre-eclampsia, eclampsia, and PPH, overlap significantly with other general medical conditions (GMC) that EPs treat (seizures, blood pressure management, hemorrhagic shock, etc.). PDs were comfortable with their graduating residents' competencies that overlapped with commonly seen GMCs, whereas they were not comfortable with their residents' competence in managing conditions that do not overlap with GMCs (e.g., shoulder dystocia and breech delivery). Likewise, the latter are more procedural in nature and more difficult to address with didactic teaching methods.

Breech deliveries are a rare procedure to perform for obstetrical residents and the likelihood that an EM resident would have an opportunity to participate in one during residency would be extremely rare.[20] Therefore, their only education would be based on didactics and simulation. The authors recognized the rarity of such events, but felt that the stakes are as high for EPs as they are for obstetrical physicians. The fact that a breech delivery is rare does not protect EPs from needing to know how to care for the patient. Future research should focus on surveying residency graduates to establish the most common obstetrical conditions seen after graduation.

LIMITATIONS

The main limitation of this study was our inability to query our population with more rigorous survey methods. Due to the concern about our collection of sensitive program information, specifically a rating of an EM resident graduate's

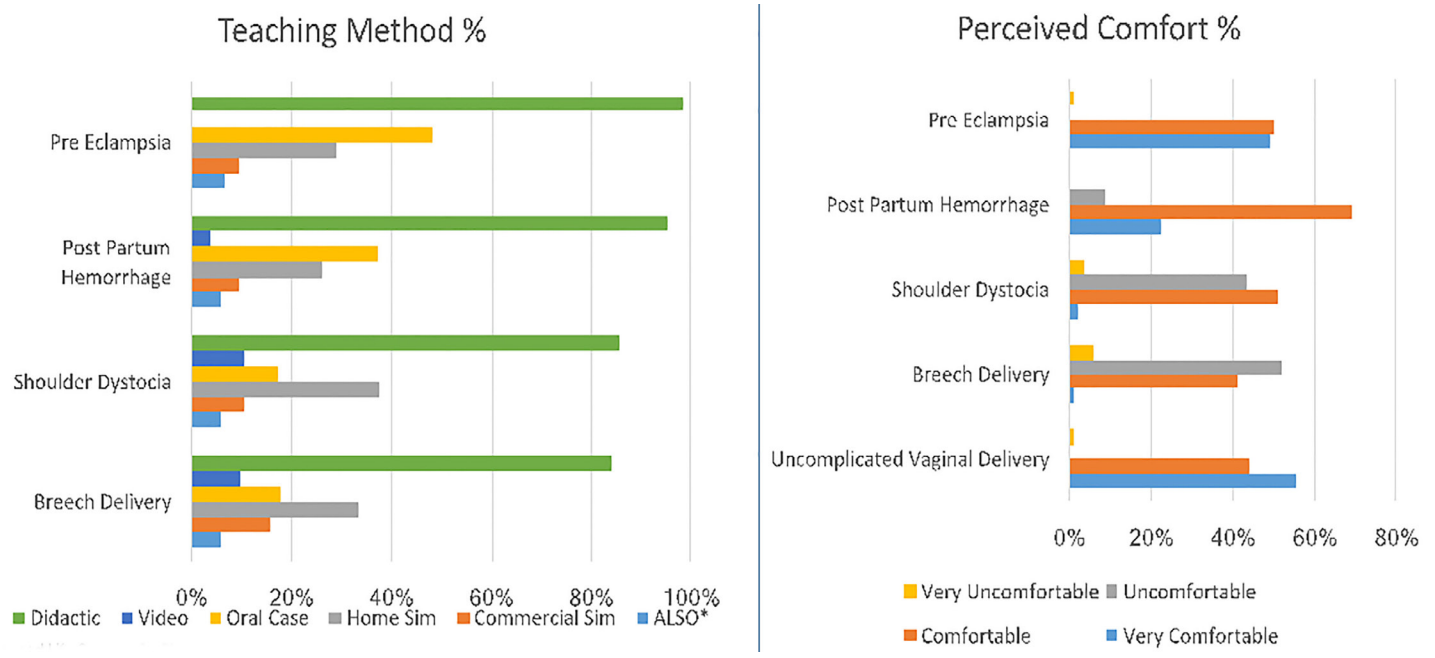

Figure. Teaching methods of obstetrical complications and program director's perceived comfort of graduates abilities.

competence in managing complicated obstetrical cases, our IRB required that our data be collected anonymously. This limited our ability to track survey respondent participation and verify that our respondents were actually PDs. However, assuming that we connected with the correct population, we believe that the provision of anonymity provided assurances to our respondents that they could answer our questions honestly without concern for their responses being revealed.

A second limitation is the study's response rate of 55%, which equates to a margin of error of 6.4%. To achieve an appreciably lower margin of error, the response rate would need to be considerably higher.

When assessing the PD's comfort level in their graduating residents' ability to treating obstetrical emergencies, our survey addressed only five of the most common and important obstetrical conditions. To keep the survey manageable in length, we did not include other less-common obstetrical emergencies such as third trimester bleeding, peri-mortem cesarean section, or proficiency in performing an episiotomy. Future research will need to survey residency graduates to establish the most common obstetrical conditions seen after graduation.

A final limitation was that we did not ask PDs about the types of obstetrical services available at their hospital training sites. This could potentially impact how much residents were exposed to obstetrical emergencies in the ED, as well as the PD's confidence in their residents' skills.

CONCLUSION

Our findings show that PDs do not feel comfortable in their graduates' competence in performing non-routine emergency obstetrical procedures. Follow-up research is planned to evaluate EM graduates' experience with obstetrical emergencies in practice after residency training.

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Flipping the Classroom in Medical Student Education: Does Priming Work?

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Introduction: The emergency medicine (EM) clerkship curriculum at Los Angeles County + University of Southern California Medical Center includes monthly lectures on pediatric fever and shortness of breath (SOB). This educational innovation evaluated if learning could be enhanced by "priming" the students with educational online videos prior to an in-class session. Factors that impacted completion rates were also evaluated (planned specialty and time given for video viewing).

Methods: Twenty-minute videos were to be viewed prior to the didactic session. Students were assigned to either the fever or SOB group and received links to those respective videos. All participating students took a pre-test prior to viewing the online lectures. For analysis, test scores were placed into concordant groups (test results on fever questions in the group assigned the fever video and test results on SOB questions in the group assigned the SOB video) and discordant groups (crossover between video assigned and topic tested). Each subject contributed one set of concordant results and one set of discordant results. Descriptive statistics were performed with the Mann-Whitney U test. Lecture links were distributed to students two weeks prior to the in-class session for seven months and three days prior to the in-class session for eight months (in which both groups included both EM-bound and non-EM bound students).

Results*:* In the fifteen-month study period, 64% of students rotating through the EM elective prepared for the in class session by watching the videos. During ten months where exclusively EM-bound students were rotating (n=144), 71.5% of students viewed the lectures. In four months where students were not EM-bound (n=54), 55.6% of students viewed the lectures (p=0.033). Participation was 60.2% when lecture links were given three days in advance and 68.7% when links were given two weeks in advance (p=0.197). In the analysis of concordant scores, the pre-test averaged 56.7% correct, the immediate post-test averaged 78.1% correct, and the delayed post-test was 67.2%. In the discordant groups, the pretest averaged 51.9%, the immediate posttest was 67.1% and the delayed by 68.8%. In the concordant groups, the immediate post-test scores improved by 21.4%, compared with 15.2% in the discordant groups (p = 0.655). In the delayed post-test the concordant scores improved by 10.5% and discordant scores by 16.9 percent (p=0.609). Sixty-two percent of students surveyed preferred the format of online videos with in-class case discussion to a traditional lecture format.

Conclusion*:* Immediate post-tests and delayed post-tests improved but priming was not demonstrated to be a statistically superior educational method in this study. Medical student completion of the preparatory materials for the EM rotation session increased when the students were EM-bound. Participation rates were not significantly different when given at two weeks versus three days. [West J Emerg Med. 2018;19(1)93-100.]

INTRODUCTION

The flipped classroom is a novel educational method recently adopted for learners at all levels including in medical school.[1-6] This teaching model has students do "homework" prior to class in order to free up class time for a more interactive and engaging session. Currently, the implementation and structure of the flipped classroom is not well defined. Additionally, it requires "buy-in" and participation from the students in order to be successful. The student must invest in the method and participate in order to learn the didactic material and to have a fruitful in-class interaction. How best to effectively implement the flipped classroom in medical education remains unknown. Self-study, formal education and clinical exposure all must occur, and each area competes for the learner's time. Education must be both effective and efficient.

The details of effective implementation of the flipped classroom are important for two reasons: (1) to obtain the "buy-in" of students to complete an assigned task prior to class; and (2) to justify the significant time investment of faculty to overhaul curriculum changes . This study sought to evaluate if "priming" prior to an in-class session improved a medical student's knowledge base, both immediately after the session and in the form of a delayed test. This study also examined factors that influenced pre-class video viewing, which contributes to the success of implementing the flipped classroom in a clerkship rotation.

Population Health Research Capsule

What do we already know about this issue?
The flipped classroom is an educational innovation with a high student-satisfaction rate. Whether it enhances education and learning retention enough to justify significant curriculum changes has not yet been demonstrated.

What was the research question?
We sought to evaluate whether priming, a component of the flipped classroom, enhanced retention of material, i.e. would students test better if they were "primed" for learning by watching videos? Additionally, would EM-bound students be more likely to complete the preparatory material, and was that completion rate affected by how far in advance the videos were distributed?

What was the major finding of the study?
While priming did not appear to impact learning retention, EM-bound students were more likely to complete the preparatory materials. Advanced distribution of pre-class education videos did not lead to a statistically significant increased viewing rate.

How does this improve population health?
When teaching innovations lead to more effective medical education it translates to enhanced patient care. Additionally, successful medical education strategies could be implemented to improve patient education.

METHODS

Study setting and population

We performed this prospective descriptive study from May 2015 to September 2016. A total of 212 students rotated through the emergency medicine (EM) clerkship at Los Angeles County + University of Southern California Medical Center, a Level I trauma center with approximately 170,000 annual visits. Four 10-minute videos were filmed by the pediatric EM faculty, which were to be viewed prior to the in-class, case-based discussion. There were two videos on fever and two on shortness of breath (SOB) (covering laryngotracheo- bronchitis/croup and bronchiolitis). Students accessed the videos via Zaption (www.zaption.com), an online service that provides instant analytics including the date, time and number of video views, average viewing time, and percent of video watched. Students were not aware that their video views were being tracked.

Study Protocol

Students were assigned to either the fever or SOB group by alternating an alphabetical list of rotators. All participating students took a pre-test prior to viewing the online lectures. Those in the fever group received lecture links to two fever videos and those in the SOB group received links to two videos on the topics of croup and bronchiolitis. For eight months (five of those months with EM-bound students and three with non-EM bound students), the links were sent three days prior to the in-class session. For seven months (five with EM-bound students and two with non-EM bound students) the links were sent two weeks prior to class ,with two additional email reminders to complete the viewing (Table 1).

The classroom session consisted of a one-hour, case-based discussion of a febrile neonate and the management of pediatric fever across age groups, and a one-hour, case-based discussion of a three-year-old child in respiratory distress ultimately discovered to have viral laryngotracheobronchitis (croup). After participation in the in-class session, all students

Table 1. Rotation student characteristics, time of material distribution, video views and average immediate post-tests.

Rotation date	Total rotating students (#)	EM-bound (#, [%])	KSOM (#)	Visiting students (#)	Video links prior to class	Video views* (#, [%])	Average immediate post-test score (%)
5/18-6/14/2015‡	17	17 (100)	17	0	2 weeks	8 (47.1)	----------
6/29-7/26/2015‡	13	13 (100)	12	1	3 days	7 (53.8)	----------
7/27-8/23/2015‡	15	15 (100)	0	15	3 days	8 (53.3)	----------
8/24-9/20/2015‡	14	14 (100)	0	14	3 days	12 (85.7)	----------
9/21-10/18/2015‡	14	14 (100)	0	14	3 days	11 (78.6)	----------
10/19-11/16/2015‡	14	14 (100)	0	14	3 days	13 (92.9)	----------
11/16-12/13/2016	14	2 (14.3)	12	2	3 days	3 (21.4)	----------
1/4-1/31/2016‡	15	0 (0)	14	1	3 days	5 (33.3)	----------
2/1-2/28/2016†‡	14	0 (0)	13	1	3 days	9 (64.3)	63.5
2/29-3/27/2016†‡	14	0 (0)	14	0	2 weeks	10 (71.4)	79.6
3/28-4/21/2016†‡	11	0 (0)	11	0	2 weeks	6 (54.5)	81.8
5/16-6/12/2016†‡	14	14 (100)	13	1	2 weeks	10 (71.4)	48.9
6/27-7/24/2016†‡	15	15 (100)	15	0	2 weeks	8 (53.3)	69.3
7/25-8/21/2016†‡	14	14 (100)	0	14	2 weeks	13 (92.9)	74
8/22-9/18/2016†‡	14	14 (100)	0	14	2 weeks	13 (92.9)	81.6

EM, emergency medicine; *KSOM*, Keck School of Medicine of the University of Southern California.
*Number of video views defined as unique views; the average viewing length was >90% of total video length.
†Months in which tests results were analyzed in concordant and discordant groups.
‡Months in which students were exclusively EM-bound, or all students were not planning to pursue EM.
--------- Scores not evaluated due to inability to match concordant and discordant groups.

immediately took another test on both fever and SOB. Following the in-class session, students in the fever group received a transcript of the SOB video and students from the SOB group received a transcript of the fever video to balance the amount of information given on each topic. A third test on these topics was administered at the end of the rotation (three weeks after the immediate post-test).

Three tests were written and reviewed by three board-certified, pediatric-trained emergency physicians. Each test contained questions on the topics of pediatric fever, bronchiolitis and laryngotracheobronchitis. The three tests (A, B, C) were rotated each month to compensate for the possibility that one test may have been more difficult than the others (i.e., test A was the pre-test, B the immediate post-test, test C the delayed post-test during month one, and in month two test B was the pre-test, C the immediate post-test, and test A the delayed post-test, etc). All participating students in a month took the same pre-test, post-test and delayed post-test. We administered a survey to all students at the end of the rotation along with the delayed post-test.

Tests that categorized discordant and concordant groups from February 2016 to September 2016 (Figure) were analyzed based on the group assigned and subject of questions. (I.e., the concordant group included the fever group's performance on fever questions and SOB group on SOB questions. The discordant group included the fever group's performance on SOB questions and the SOB group on fever questions.) Each subject contributed one set of concordant results and one set of discordant results.

Study participation was voluntary and anonymous. The study was approved by the University of Southern California's Institutional Review Board. Students reported their specialty of interest via declaration in the visiting student application service application as well as in a post-rotation anonymous survey. Only months in which all students stated an interest in EM and months in which no students stated an interest in EM were used for analysis of completion rates (see Table 1). We queried the Zaption system for monthly reports on the number of video views and total minutes of video watched. We identified unique views by the student's anonymous viewing "name," which was required to view the video. Views that lasted only seconds were not counted.

Key outcome measures

The primary outcome measured was the difference in improvement of test scores from pre-test to immediate post-test between test questions concordant with the video(s) viewed and test questions discordant with video(s) viewed (e.g., fever questions from participants watching the fever video vs. fever questions for participants watching the SOB video). For purposes of data analysis, we used an intent-to-treat model with participants analyzed as assigned, regardless of whether they

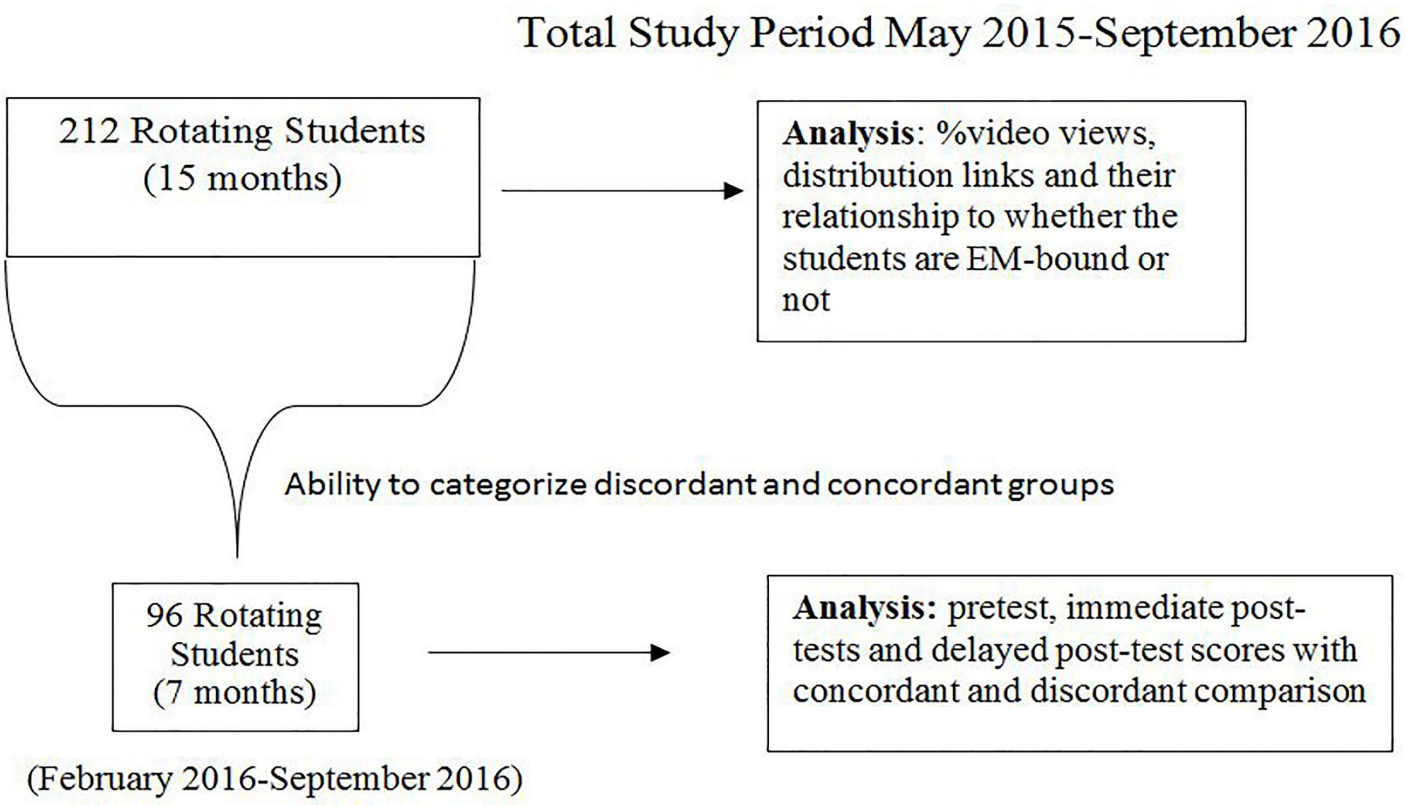

Figure. Inclusion period for a study of the "flipping classroom" educational method with 212 students rotating in emergency medicine from May 2015 – September 16

viewed the video or not. The secondary outcome measures included overall improvement in scores and difference in scores between the pre-test and delayed post-tests, both overall and within concordant and discordant groups.

In the second portion of analysis, the outcome measure was completion of the video. The variables evaluated were specialty of interest (EM vs. other specialty) and time of distribution of the lecture links (two weeks vs. three days).

Data analysis

We analyzed the percent questions correct and change in percent questions correct between concordant groups as well as discordant groups. Because the tests were taken anonymously the unit of measurement was total change per group per month. The difference was analyzed for significance using the Mann-Whitney U test per the small sample size.

We determined medical student lecture viewing by the Zaption video logs. We reviewed the log during the time period from lecture link distribution to in-class session.

Using a chi-square statistic, we compared the difference in number of students viewing the lectures who were EM bound with those who were not. A similar comparison with chi-square analysis was made between students who viewed the lectures with three days' notice vs. two weeks' notice.

RESULTS

In the analysis of concordant scores, the pre-test averaged 56.7% correct, the immediate post-test averaged 78.1% correct, and the delayed post-test was 67.2%. In the discordant groups, the pre-test averaged 51.9%, the immediate post-test averaged 67.1% correct, and the delayed post-test was 68.8%. In the concordant groups, the immediate post-test scores improved by 21.4%, compared with 15.2% in the discordant groups ($p = 0.66$). In the delayed post-test the concordant scores improved by 10.5% and discordant scores by 16.9 percent ($p=0.61$). (See Table 2 and sample test supplemental material A.)

We queried students via an anonymous survey regarding their engagement with the videos, the case discussion and their preferred format (supplemental material B). Surveys were collected for nine months of data collection (two months more than test data collection). We collected 97 surveys. When asked, "how engaged are you with a traditional lecture format?," students answered a median of 5.3 on a seven-point Likert scale (where 1 indicated "not engaged" and 7 indicated "highly engaged"). The students reported a median of 5.0 engagement with the online videos. When asked which format they preferred, 34 students (35% who completed the survey) preferred traditional lecture and 60 students (62% surveyed) preferred the combined format of pre-class online videos with in-class case discussion. (See

Table 2. Average test scores for concordant and discordant groups.

Group	Pre-test (%)	Immediate post-test (%)	Percent difference from pre-test	Concordant v. discordant‡	Delayed post-test (%)	Percent difference from pre-test	Concordant v. discordant‡
Concordant*	56.7 (35.7-75.4)	78.1 (54.5-87.5)	21.4	P=0.66	67.2 (56.3-87.5)	10.5	P=0.61
Discordant†	51.9 (42.9-77.2)	67.1 (50.9-83.3)	15.2		68.8 (55.4-86.1)	16.9	

*Concordant group: performance on fever questions by those who were in the fever group and performance on shortness of breath (SOB) questions by those who were in the SOB group

†Discordant group: performance on SOB questions by those who were in the fever group and performance on fever questions by those who were in the SOB group

‡P-values calculated difference between concordant vs. discordant scores using Mann-Whitney U statistics

discussion below regarding this apparent conflict of results on the survey).

Specific comments by students regarding the two educational formats and the flipped classroom method are summarized in supplemental material C.

In the 15-month study period, 64% of students rotating through the EM elective viewed the priming videos (Table 1). During the 10 months in which exclusively EM-bound students were rotating (n=144), 71.5% (47.1-92.9) of students viewed the lectures. In the four months in which students were not EM-bound (n=54), 55.6% (33.3-71.4) of students viewed the lectures (Table 3a, p=0.033).

Participation was 60.2% (33.3-92.9) when lecture links were given three days in advance and 68.7% (47.1-98.9) when links were given two weeks in advance (Table 3b; p=0.197). Video viewing time averaged >90% of total video length.

Table 3a. Video viewing based on future specialty and time to dissemination of lecture links: The number of students who viewed optional educational online lectures prior to class session.

	EM-bound students (144)	Non-EM bound students (54)	p-value
Viewed	103	30	
Not viewed	41	24	0.033

EM, emergency medicine.

Table 3b.Time to dissemination: The number of students who viewed lectures with three-day and two-week notice (EM and non-EM bound combined).

	3 day (n=113)	2 weeks (n=99)	p-value
Viewed	68	68	
Not viewed	45	31	0.197

EM, emergency medicine.

DISCUSSION

The flipped classroom has been used in many educational venues.[3,4,7-13] While learner experience has been favorable, few data are available on its effectiveness in medical education.[1,2,4,14] Proving the flipped classroom's effectiveness is challenging, as the details of implementation are not well defined. This study evaluated the effectiveness of priming on a topic with the students serving as their own control, as they were tested on two topics and only primed on one. Post-test scores improved, but there was not a statistically significant difference in scores on the students' "primed" topic. This may be because either priming may not significantly impact learning or the tests were too short to determine a difference.

The flipped classroom's success correlates with learner participation. This study found a statistical difference in video completion rates of EM-bound students compared to students pursuing other specialties. Completion rates of preparatory materials by students using the flipped classroom have been reported with varying degrees of participation;[1,5] and literature is sparse regarding engagement and/or participation of medical students based on their planned specialty. In this study, the preparatory material for the flipped classroom was optional and in addition to the required learning for the clerkship. Despite this fact, the majority (64%) of students viewed the videos prior to class. This indicates an overall favorability to electronic-enhanced education.

Preparatory material must be completed prior to the in-class session in the flipped classroom. One week in advance may be the ideal time to distribute materials, but a definitive answer is not yet known.[16,17] This study demonstrated that three days' notice appears to be adequate for distribution of materials for the flipped classroom, as we found no statistical difference in completion rates between groups that received three days' vs. two weeks' notice to view the videos.

Learners reported a high satisfaction rate with the flipped classroom model and appreciated the flexibility and efficient presentation of material.[1-6,18] We posit that because EM was the chosen field of EM-bound students this likely increased

clinical relevance and significantly contributed to the fact that they more commonly viewed the lectures compared to peers pursuing other fields.

The ideal format of preparatory materials and quantity of material to be prepared is not yet known in flipped- classroom implementation.[19-23]Approximately 60 minutes of preparatory time has been recommended but not rigorously evaluated, particularly in medical student education.[16,17,24] Online videos were used in this study as video learning has been demonstrated to be effective.[20,25] However, the ideal format of electronic education is still unknown.[19,21,22,26,27] Interpolated questions were not used in this study but have been previously shown to promote superior knowledge retention and learner engagement with the material.[1,28] Online educational methods particularly appeal to the millennial generation, which is less tolerant of a traditional lecture format.[13,14,29] Additionally, adult learners tend to prefer independence, freedom and flexibility in their learning environment.[30]

Surveyed students reported being more engaged with a "traditional lecture" rather than the online video, but the majority answered in a different question that the method of priming online videos was overall preferred. A possible explanation for this apparent contradiction is that the distributed survey asked a question that was not clear to the students regarding the traditional lecture. Some students interpreted it to ask about the interactive case session with the faculty and others interpreted it to mean a "traditional" didactic lecture that was not interactive or case-based. Multiple students commented that they felt more prepared for the session and were able to interact with the material better after watching the video. They also appreciated that they could view the videos on their own time and at their own pace. They felt more prepared for the case discussion and could ask clinically relevant questions of a more complex nature. (See specific student comments in supplemental material C.)

In this study overall, 64% of students viewed the lectures prior to the class session. This completion rate is similar to other reported flipped-classroom participation.[31] Accountability in the implementation of the flipped-classroom model may be an issue and impact its effectiveness. If essential didactic material is to be covered, students must participate and prepare prior to class time. Self-reported completion rates may not match actual completion rates when video viewing logs are reviewed.[1]

LIMITATIONS

There were several limitations to this preliminary and descriptive study. Primarily, the preparatory material in a flipped classroom is typically mandatory. In this study, to avoid a sense of coercion to participate in research the video material was optional. Viewing rates may have increased if they were required. Additionally, no subject number was given to each student. It is possible that a single student logged onto the system using a different name and viewed the material more than once but was counted as an additional student viewing the videos. It is also not known if the student actually watched the video or merely let it play while engaging in other activities. Interpolated questions within the videos may have increased learner engagement and promoted more active learning during video viewing. Tracking video view times and interpolated question responses may add to the value of the priming videos and increase the success of the flipped classroom.

The association between material completion and interest in EM is assumed to have occurred because the material matched the students' field of interest, but this may be due to increased level of compliance overall by EM-bound students. Similar studies in other core and elective rotations would be needed to verify causality. The time of year (and relation to match- and rank-list submission) may also play a role in medical student participation. This was not examined in this study. Additionally, there may be a Hawthorne effect of students participating in a study. They may have participated more and been influenced to prefer the format. This study was also performed at a single site and may not be generalizable to other institutions.

Despite gathering test data for seven months with nearly 100 students, the sample size may not have been large enough to show a difference on test scores. Additionally, each test was six questions and likely of varying degrees of difficulty. The tests used to evaluate learning were peer reviewed but not validated prior to the study, which limits the power of results. Test validity is a challenge in assessing knowledge.[32] This may account for the lack of statistical significance between the concordant and discordant groups. The survey was also not piloted prior to study administration. Additionally, in an attempt to facilitate ease of participation and preserve anonymity in test administration, no subject number was given to each student. Therefore, we were not able to make a direct comparison of pre-test to post-test scores , which may also have limited statistical significance.

CONCLUSION

Immediate post-tests and delayed post-tests improved, but priming was not demonstrated to be a statistically superior educational method in this study. Though the students' concordant test scores were not statistically superior, the preference of surveyed students was to be offered additional priming material prior to an interactive case discussion. Medical student completion of the preparatory materials increased when rotating students were EM bound. Participation rates were not significantly different when lecture links were distributed at two weeks vs. three days, although there was a trend toward greater viewing compliance when links were sent out two weeks in advance.

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Conflicts of Interest: By the *West*JEM article submission agreement, all authors are required to disclose all affiliations, funding sources and financial or management relationships that could be perceived as potential sources of bias. No author has professional or financial relationships with any companies that are relevant to this study. There was no funding for this study and the authors have no significant conflicts of interest. However, multiple faculty (Emily Rose, Paul Jhun, Yvette Liza Kearl, Solomon Behar, Ilene Claudius) have been paid by the Hippo EM education company for educational material. The videos used in this study are commercially available through HIPPO EM as the Pediatric Foundations course.

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Does the Podcast Video Playback Speed Affect Comprehension for Novel Curriculum Delivery? A Randomized Trial

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Introduction: Medical education is a rapidly evolving field that has been using new technology to improve how medical students learn. One of the recent implementations in medical education is the recording of lectures for the purpose of playback at various speeds. Though previous studies done via surveys have shown a subjective increase in the rate of knowledge acquisition when learning from sped-up lectures, no quantitative studies have measured information retention. The purpose of this study was to compare mean test scores on written assessments to objectively determine if watching a video of a recorded lecture at 1.5x speed was significantly different than 1.0x speed for the immediate retention of novel material.

Methods: Fifty-four University of Kentucky medical students volunteered to participate in this study. The subjects were divided into two separate groups: Group A and Group B. Each group watched two separate videos, the first at 1.5x speed and the second at 1.0x speed, then completed assessments following each. The topics of the two videos were ultrasonography artifacts and transducers. Group A watched the artifacts video first at 1.5x speed followed by the transducers video at 1.0x speed. Group B watched the transducers video first at 1.5x speed followed by the artifacts video at 1.0x speed. The percentage correct on the written assessment were calculated for each subject at each video speed. The mean and standard deviation were also calculated using a t-test to determine if there was a significant difference in assessment scores between 1.5x and 1.0x speeds.

Results: There was a significant (p=0.0188) detriment in performance on the artifacts quiz at 1.5x speed (mean 61.4; 95% confidence interval [CI]-53.9, 68.9) compared to the control group at normal speed (mean 72.7; 95% CI- 66.8, 78.6). On the transducers assessment, there was not a significant (p=0.1365) difference in performance in the 1.5x speed group (mean 66.9; CI- 59.8, 74.0) compared to the control group (mean 73.8; CI- 67.7, 79.8).

Conclusion: These findings suggest that, unlike previously published studies that showed subjective improvement in performance with sped-up video-recorded lectures compared to normal speed, objective performance may be worse. [West J Emerg Med. 2018;19(1)101–105.]

INTRODUCTION

Medical education is a rapidly evolving field that has been using new forms of media and technology to enhance the learning of medical students across the U.S. One of the more prevalent and extensively used advancements is the use of video recording systems. In previous studies, medical students have reported greater subjective benefit from video-recorded lectures than from live lectures.[1,2,3] Some of the subjective benefits that students reported included faster knowledge acquisition, better retention of material, more focus, and easier access to additional information.[1]

The advantages to using video-recorded lectures include the ability to rewind, pause and return to finish a lecture later, and watch lectures at faster speeds. In a medical school setting where knowledge of minutiae and comprehension of concepts is paramount to success, the added flexibility that video-recorded lectures provide could be extremely important. As medical education demands countless hours of studying, the biggest advantage may be the ability to watch lectures at faster speeds. As an example, for every hour of material in the traditional classroom setting played at 1.5x speed, a student could save 20 minutes. Therefore, in a typical four-hour morning lecture scenario, a student could save 80 minutes by watching the video at 1.5x speed.

Though the benefits may seem numerous and prior survey studies have shown subjective benefits with lectures played at faster speeds, no quantitative studies to date have measured information retention. The objective of this pilot study was to determine if watching video-recorded lectures at faster speeds compared to the original recording had any effect on the immediate retention of novel learning material.

Population Health Research Capsule

What do we already know about this issue?
Previous survey studies have shown a subjective increase in the rate of knowledge acquisition from sped-up lectures. However, no quantitative studies have measured objective retention.

What was the research question?
Would students' mean test scores differ significantly after watching video lectures at 1.5x speed compared to 1.0x speed?

What was the major finding of the study?
We found that watching a lecture at a faster speed may have a detrimental or no significant effect on learning novel material.

How does this improve population health?
This data is important to modern learners as it challenges the assumption that faster podcast speeds lead to potential time savings for learners.

METHODS

This was a prospective, single-center, randomized controlled trial, pilot study that presented a novel curriculum to medical students and tested information retention with a short examination. Material presentation and assessments were all done in a single day. The study was approved by the university institutional review board (IRB), as well as by the administration of the medical school involved.

Video selection and assessment creation

The two new educational subjects chosen were transducers and artifacts. The presented videos were recorded by a nationally recognized emergency ultrasound educator. These two specific videos were chosen because these topics are not covered in the medical school curriculum and, therefore, we believed that the material presented was novel. Subjects were also asked if they had exposure to the material; if they had, they were excluded from the study. Additionally, these videos were similar in length (transducers, 12 minutes; artifacts, 15 minutes) and "factoid heavy," or in other words, had a wealth of material that could be used to assess student learning.

We created a 23-question multiple-choice assessment for the transducers video, and a 20-question assessment for the artifacts video. Given the pilot nature of the study, the assessments were tested by the two medical students involved in the study as well as by the video creator and content experts to ensure that the two tests were of comparable difficulty levels. To avoid different interpretations of a correct answer, the tests asked about definable facts explicitly stated in the video. The investigators created an answer key for both assessments, which were subsequently reviewed and proofread before submission to the IRB.

Subject recruitment and privacy

We conducted the experiment in August, at the beginning of the school year, when first-year (M1), second-year (M2) and third-year (M3) medical students had limited exposures to emergency medicine (EM). Subject recruitment was conducted by first sending an email to all four medical school classes. This was then followed by live announcements to each class. All students were told that results on the assessments would have no effect on medical school evaluations or grades and that participation was voluntary. Students who participated were given a $5 Starbucks gift card

as a token of appreciation.

Inclusion criteria for subjects included being a medical student and being over the age of 18. The primary exclusion criterion was having been exposed to the presented material before, since prior knowledge of the subjects could skew the results. Additionally, medical students with prior ultrasound experience and students rotating in EM were excluded from the study.

To enforce the exclusion criteria, each participant was asked to enroll via Google Docs and sign an informed consent prior to the study. Each student was asked to answer "yes" or "no" to having previously seen either the transducers video or the artifacts video. Those who answered "yes" received the $5 Starbucks gift card and the opportunity to sit in on the study, but they were excluded from examination and data analysis. To protect the privacy of student performance, each student was identified by his/her student ID number. Demographic data including ethnicity, gender, and year in medical school were also collected. Assessment performance was not shared with the medical school.

Presentation and assessment

Of the 81 students who signed up for the study, 63 showed up on the day of the experiment. Two were excluded from the examination for having prior knowledge of the material, and seven were excluded from assessment for arriving late. As a result, 54 medical students were included in the final data analysis. Participants were randomized into group A or B by converting the Google docs sign-up document to a Microsoft Excel spreadsheet, and then using the "randomize" function to assign participants into either group A or B. On the date of the experiment, participants could see their group assignment at the check-in desk.

Group A watched the artifacts video at 1.5x speed first and then took the artifacts assessment immediately after the video. Following this, Group A watched the transducers video at normal speed and immediately took the transducers assessment. Group A served as the experimental group for the artifacts video and the control group for the transducers video. Group B watched the transducers video at 1.5x speed first and took the corresponding assessment immediately following the video. Group B then watched the artifacts video at normal speed and took the assessment. Group B served as the experimental group for the transducers video and the control group for the artifacts video.

Scoring and statistical analysis

Since the two assessments had an unequal number of questions, the scores were converted into a percent correct score. Then the means and standard deviations (SD) of the variable of interest and percentage score were calculated for each assessments (Group A Artifacts, Group A Transducers, Group B Transducers, and Group B Artifacts). Group A Artifacts at 1.5x speed was compared to Group B Artifacts at normal speed using a t-test. Similarly, Group B Transducers at 1.5x speed was compared to Group A Transducers at normal speed using a t-test. To compare the demographic information, such as year in medical school, gender, and ethnicity, the Fisher's exact test was used. The p-values were used to determine if there was a significant difference in performance for both videos. Statistical significance was set at $p < 0.05$. All analyses were completed in R version 3.4.1 (R Core Team; Vienna, Austria).

RESULTS

Subject data

A total of 54 students participated in the study. Of these, 21 were M1s, 27 were M2s, two were M3s, and four were M4s. Thirty participants were female and 24 were male. Finally, seven participants self-identified as Asian American, one as African American, 45 as Caucasian, and one participant chose not to provide ethnicity (Table 1).

There was a similar distribution of M1, M2, M3, and M4 in each group. Among the 21 M1s, 11 were in Group A and 10 in Group B. Among the 27 M2s, 14 were in Group B and 13 in Group B. Each Group A and B had three M3 and M4 participants.

Assessment results

The average performance of Group A on the assessment for Artifacts at 1.5x speed ± SD was 61.4 ± 19.3% (95% CI [-53.9, 68.9]). On the Transducers assessment at normal speed, Group A's mean performance was 73.8 ± 15.6% (95% CI [-67.7, 79.8]) (Table 2).

The average performance of Group B on the assessment for transducers at 1.5x speed was 66.9 ± 17.6% (95% CI [-59.8, 74.0]). For artifacts at normal speed, Group B averaged 72.7 ± 14.6% (95% CI [-66.8, 78.6]).

For both videos, the performance of the control and experimental groups were compared using the t-test, and estimated the effect sizes using Cohen's d. For the artifacts video, there was a significant difference between the performance at 1.5x speed compared to 1.0x speed ($p= 0.0188$), along with a moderate effect size (Cohen's $d = 0.654$). For the transducers video, a statistically non-significant ($p= 0.1365$) difference was found in the performance between the two groups along with a small effect size (Cohen's $d = 0.414$).

We compared the performance of the control groups of artifacts and transducers videos using the t-test and found no significant difference ($p= 0.7965$), suggesting that the tests did not differ in difficulty.

DISCUSSION

We chose to conduct a quantitative analysis of students' information retention after viewing a sped-up video compared to retention at normal speed because there was

Table 1. Demographic information of study subjects (we used Fisher's exact test to compare the demographic information).

	Overall	Group A	Group B	P-value
No. of participants	54	28	26	N/A
Year of medical school, n (%)				
1st	21 (38.9)	11 (39.3)	10 (38.5)	
2nd	27 (50.0)	14 (50.0)	13 (50.0)	
3rd	2 (3.7)	2 (7.1)	0 (0.0)	
4th	4 (7.4)	1 (3.6)	3 (11.5)	
				0.5224
Gender, n (%)				
Female	30 (55.6)	18 (64.3)	12 (46.2)	
Male	24 (44.4)	10 (35.7)	14 (53.8)	
				0.5224
Race, n (%)				
African American	1 (1.9)	0 (0.0)	1 (3.8)	
Asian	7 (13.0)	4 (14.3)	3 (11.5)	
Caucasian	45 (83.2)	23 (82.1)	22 (84.6)	
No Response	1 (1.9)	1 (3.6)	0 (0.0)	
				1.000

Table 2. Quiz results: we used a t-test to compare the mean of 1.5x vs. 1.0x speed. For the artifacts video, the difference in average performance after 1.5x speed compared to 1.0x speed was significant. For transducers, the difference in average performance after 1.5x speed compared to 1.0x speed was not significant.

	Overall	1.0x Speed	1.5x Speed	P-value
Artifacts		(Group B)	(Group A)	
No. of Participants	54	26	28	N/A
Mean	66.9	72.7	61.4	0.0188
Standard Deviation	18.0	14.6	19.3	
95% CI		66.8, 78.6	53.9, 68.9	
Median (Quartiles)	65.0 (56.3, 80.0)	75.0 (65.0, 80.0)	60.0 (50.0, 75.0)	
Transducers				
		(Group A)	(Group B)	P-value
No. of Participants	54	28	26	N/A
Mean	70.5	73.8	66.9	0.1365
Standard Deviation	16.8	15.6	17.6	
95% CI		67.7, 79.8	59.8, 74.0	
Median (Quartiles)	69.6 (56.5, 87.0)	73.9 (64.1, 88.0)	69.6 (52.2, 81.5)	

CI, confidence interval.

a lack of literature regarding the topic. To assess retention, novel education material was presented to the test subjects one at normal speed and another at 1.5x speed and assessed comprehension after each video. Participants overall performed worse on assessments after learning from 1.5x speed compared to 1.0x speed. For the artifacts video, the average test score was 72.7 at 1.0x speed compared to 61.4 at 1.5x speed. For the transducers video, the average test score was 73.8 at 1.0x speed compared to 66.9 at 1.5x speed. Our findings were contrary to previous studies that

reported subjective, accelerated learning when learning from videos at faster speeds.

The difference in performance on the artifacts quiz at 1.5x speed compared to the control group was significant. Although the difference in performance of the 1.5x group compared to the control group was not significant for the transducers video, the difference was equivalent to a letter-grade difference.

The discrepancy in relative performance between control and experimental groups for each of the videos may be explained by confounding factors. The main confounding error that may have led to the difference in results was that the artifacts video and assessment may have been more inherently complex in nature compared to the transducers video and assessment. Although the video selection was done deliberately to ensure videos were similar in length and in the amount of fact content covered, retrospectively we realized that for a novice learner, a few of the questions on the artifacts video may have been more conceptual compared to the transducers questions.

For example, many students answered correctly to the question asking about the A line on the artifacts video, much in the same way they answered correctly about the linear transducer having a higher frequency. However, with no prior knowledge of how ultrasound works, many students answered incorrectly on posterior acoustic shadowing vs. enhancement. As one participant later remarked, as a new learner she focused all her cognitive energy learning to associate that stones cause sound waves to reflect back, which made her associate stones with the word "enhancement." However, someone with a basic concept of ultrasound would have easily picked up that because of this reflection of sound waves off the stone, there would be shadowing of the structures lying posterior to it. We theorize that when learning multiple-step processes such as these, playback speed plays a more significant role than when learning a rote memorization fact.

This data is important to modern learners as it challenges the assumption that faster podcast speeds lead to potential time savings for learners. This time savings is only realized if the retention of the material is comparable.

LIMITATIONS

Among this study's limitations was the small sample size of 54 students that limited the power of this study. Also, even though students with prior exposure to subject material were excluded from the study, it was impossible to ensure that the entire study population was naïve to the material. Another limitation was the inability to establish that the two novel subject matters presented were equivalent in complexity, as discussed above. Final noteworthy point was our decision to play the 1.5x speed video before the 1.0x speed. This may have affected performance and impacted the study results.

Future studies

This study was designed to examine the immediate recall of information after watching a video at 1.5x speed vs. at normal speed. However, to emulate the full utility of video-recorded lectures, students must be given the ability to rewind parts of the lecture they did not understand or re-watch a lecture a second time. A potential study design to examine this could involve giving both the experimental and control groups the same allotted time to learn a lecture while using 1.0x speed or 1.5x speed and comparing their performance. Long-term information retention is another variable that should be assessed. This study only tested immediate recall.

CONCLUSION

Our study suggests that watching a video lecture at a faster speed may have detrimental or no significant effect on learning novel material. Contrary to previous studies showing subjective improvement in performance with sped-up, video-recorded lectures compared to normal speed, our data showed that immediate retention of novel material at 1.5x speed was worse compared to normal speed.

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Emergency Medicine Residency Applicant Characteristics Associated with Measured Adverse Outcomes During Residency

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Introduction: Negative outcomes in emergency medicine (EM) programs use a disproportionate amount of educational resources to the detriment of other residents. We sought to determine if any applicant characteristics identifiable during the selection process are associated with negative outcomes during residency.

Methods: Primary analysis consisted of looking at the association of each of the descriptors including resident characteristics and events during residency with a composite measure of negative outcomes. Components of the negative outcome composite were any formal remediation, failure to complete residency, or extension of residency.

Results: From a dataset of 260 residents who completed their residency over a 19-year period, 26 (10%) were osteopaths and 33 (13%) were international medical school graduates A leave of absence during medical school (p <.001), failure to send a thank-you note (p=.008), a failing score on United States Medical Licensing Examination Step I (p=.002), and a prior career in health (p=.034) were factors associated with greater likelihood of a negative outcome. All four residents with a "red flag" during their medicine clerkships experienced a negative outcome (p <.001).

Conclusion: "Red flags" during EM clerkships, a leave of absence during medical school for any reason and failure to send post-interview thank-you notes may be associated with negative outcomes during an EM residency. [West J Emerg Med. 2018;19(1)106-111.]

INTRODUCTION

The application process for emergency medicine (EM) residencies is designed to not only allow the applicant to evaluate different programs, but to also allow residency programs to determine which residents will be a good fit for their program. Residencies examine various applicant characteristics and try to assess not only which applicants will fit in but which will also hopefully thrive in their program. This screening process is also a key part of attempting to predict which applicants may experience difficulty during training, whether it is due to inadequate medical knowledge, poor patient care or issues with professionalism. If these applicants make it through the application process and matriculate, they can cause a disproportionate drain on the residency's teaching and leadership resources, create interpersonal difficulties among the residents or create service hardships through lost resident work effort relating to a leave of absence or dismissal from the program.

Attempts at predicting success in an EM program through the analysis of applicant characteristics has been done in a number of previous studies[1-6] as well as in obstetrics/gynecology[7] and orthopedic surgical residencies,[8] among others.

Surgery programs have found a weak correlation between USMLE scores and certain tests of gross manual dexterity.[9]

However, the reverse question has not been as well studied and we were unable to identify studies that specifically target applicant characteristics related to poor performance in EM residency. Corrective action during a residency, such as formal letters of deficiency (LoD) for performance or professionalism and letters of reprimand (LoR) for issues dealing with professionalism, are considered negative outcomes since they typically precede an extension, and residents subject to discipline may be at risk of dismissal, leaving a residency with few options to replace the lost individual.

We initiated a retrospective analysis of applicant and resident data in the past 19 years of records currently held by the University of Connecticut (UConn) EM residency program to determine if there are characteristics in the residency application that are associated with negative outcomes during residency.

Population Health Research Capsule

What do we already know about this issue?
Prior research relied on subjective endpoints of resident outcomes but did not identify features of emergency medicine applicants associated with objective negative outcomes in residency.

What was the research question?
We sought to determine if any EM applicant characteristics are associated with negative outcomes during residency.

What was the major finding of the study?
Leave of absence and the lack of a thank-you note sent to the program were found to be independent predictors of negative outcomes.

How does this improve population health?
These findings may help residencies identify which EM applicants are at risk of compromising residency resources devoted to patient care and negatively impacting population health.

METHODS

We analyzed the dataset to see if there was an association between a variety of different applicant characteristics and any measured negative outcome, including LoRs, LoDs, extension of residency (EXT) and failure to finish residency in our program (DNF). This study received a waiver from the

UConn Institutional Review Board as a quality improvement study. This was a purely investigational study designed to elicit details about the evaluation of future residency applicants through the retrospective analysis of existing data from previous years of archived data on residents who matched at the U Conn EM residency.

All data were manually collected by the program coordinators (L.L. & L.T.) from the Electronic Residency Application Service (ERAS) applications in the matriculated resident personnel files held by UConn's EM residency. The coordinators already had access to the data used in this study and assigned each application a unique random identifier to de-identify residents for the dataset. Applicant details such as gender, medical school attended and year of graduation from medical school or residency were removed, and the data was anonymized using two different randomization schemes known only to the coordinators to prevent possible identification of residents from the research database. We input the applicant data into a Microsoft Excel spreadsheet (Redmond, WA). Negative outcomes, if present, were input from resident files and are listed in Table 1.

We used IBM SPSSv 21 (Armonk, NY) for analysis of the different variables. The primary analysis consisted of looking at the association of each of the descriptors with the composite measure of negative outcome using chi-square tests of proportion or Fisher's exact test when cell frequencies were low (Appendix A). The list of the descriptors used were as follows: those with a Doctor of Medicine (M.D.) degree vs. those with a Doctor of Osteopathic Medicine (D.O.) degree; the presence of a prior career; the presence of prior healthcare experience; U.S. vs. international medical school graduate (IMG); whether a leave of absence was taken during medical school; failure to transmit medical transcripts to ERAS; whether a post-interview thank-you note was sent; and the presence of "red flags" during EM clerkship (defined as marked deficiencies in letters of recommendation from the clerkship director or written comments from attending or resident physicians from UConn medical school clerkship rotations).

United States Medical Licensing Examination (USMLE) Step 1 and Step 2 scores, average interview score, and the resident's position on the final rank list are continuous variables and were evaluated by Wilcoxon ranked-sum test, comparing the subgroups defined by the composite measure. As these factors are likely to be interrelated, we used a multivariate approach to determine which factors independently were related to a negative outcome. A logistic regression model was created using those factors that showed a significant result with the outcome variable (Appendix B). (Because information on "red flags" was available for only a small subgroup, we eliminated them from the multivariate analysis.)

Table 1. Applicant characteristics entered into research database.

Descriptor
USMLE Step 1
USMLE Step 2CK
USMLE Step 2CS
USMLE Step 3
COMLEX
Leave during medical school
"Red flags" during EM clerkship
Failure to transmit medical school transcripts to ERAS
Surgical clerkship grade
Pediatric clerkship grade
OB/GYN clerkship grade
Psychiatry clerkship grade
Overall GPA
Class rank
Medical school rank
Undergraduate major
MD vs DO
IMG (yes/no)
Prior career (yes/no)
Prior healthcare experience (yes/no)
Average interview score
Program director score
Post interview thank you note sent (yes/no)
Number of final rank list

USMLE, United States Medical Licensing Examination; *CK*, clinical knowledge; *CS*, clinical skills; *COMLEX*, Comprehensive Osteopathic Medical Licensing Examination; *EM,* emergency medicine; *ERAS,* Electronic Residency Application Service; *OB/GYN,* obstetrics and gynecology; *GPA*, grade point average; *MD*, doctor of medicine; *DO*, Doctor of Osteopathic Medicine; *IMG*, international medical graduate.

RESULTS

The population of the dataset was 260 residents, 26 of whom were D.O.s (10%) and 33 (13%) IMGs. (All of the IMGs were allopaths but for the purposes of reporting will be listed as an IMG). There were 49 residents with one or more of the negative outcomes, representing 18.8% of the total 260 residents over the past 19 years. There were 19 LoRs, 23 LoDs for any reason, 13 residents had to extend their residency, and eight did not finish the program.

Among the 23 LoDs, 16 (10 M.D., four IMG, two D.O.) did not have a specification listed; three (two M.D., one IMG) were for patient care; three (two M.D., one IMG) were for medical knowledge; and eight (six M.D., two IMG) were for professionalism. Some letters were combined so that one letter may have contained two elements; e.g., a single letter noting deficiencies in both patient care and medical knowledge were counted as separate in this study.

Of the 13 residents who had to extend their residency training, nine were M.D.s, three IMGs and one was a D.O. Two extensions were due to problems with patient care (one M.D., one IMG); two for medical knowledge (one M.D., one IMG) and six were due to lack of professionalism (four M.D., two IMG). Of the eight residents who did not finish the program, all were allopaths; two of the eight were IMG, but this was not statistically significant. Interestingly, of the eight residents who did not finish three had prior healthcare experience, although this was not statistically significant.

The single factor most associated with a negative outcome was a prior leave of absence in medical school for any reason. The data kept by the program did not specify the reason for the leave of absence, just that a leave had occurred. Residents with a leave of absence in medical school for any reason had an increased likelihood of a negative outcome in 94.1%% vs. 5.9% for the residency in general, $p<0.001$.

Thank-you notes appeared to have an inverse correlation with negative outcomes. The residency recorded whether or not a thank-you note had been sent after the applicant was interviewed. Residents who did not send a thank-you note after their interviews had an increased likelihood of any negative outcome (25.5% vs 12.4%, $p=0.008$).

Residents who received a failing score on the USMLE Step I exam during medical school were significantly more likely to have had a negative outcome during training (46.2% vs. 17.5%; $p= 0.020$). "Red flags" during the applicant's EM clerkship had a very strong correlation with the negative outcomes we tracked in this study. A specific notation was made in the file of an applicant if a resident or attending working with the applicant at one of the UConn clinical sites or a letter of recommendation from another program raised grave concerns about the student's performance in the emergency department or professionalism. Residents with a "red flag" in their application had a 100% vs. 6% ($p=<0.001$) chance of a negative outcome during residency compared to residents who had no "red flags."

A logistic regression (Appendix C) predicting the composite of any negative outcome was run with dichotomous predictors for whether a thank-you letter was sent, a leave of absence was taken during medical school, the applicant had a prior career in healthcare, and a failing score on the USMLE Step 1 test entered simultaneously. Leave of absence ($p.<.001$) and the lack of a thank-you note ($p =.004$) were found to be independent predictors of negative outcome (Table 2).

DISCUSSION

This study found that many of the discriminators that are part of the ERAS residency application did not have an association with the negative outcomes in our dataset. Our

Table 2. Resident characteristics and factors' effect on composite measure of negative outcomes.

Factor (measurement)	No negative outcomes (N=211)	One or more negative outcomes (N=49)	P value
Degree (N, %)			
Yes	188 (80.3)	46 (19.7)	.432
No	23 (88.5)	3 (11.5)	
Prior health experience			
Yes	62 (80.5)	15 (19.5)	.798
No	149 (81.9)	33 (18.1)	
Prior career in health			
Yes	48 (72.7)	18 (27.3)	.034
No	163 (84.5)	30 (15.5)	
Foreign medical school			
Yes	24 (72.7)	9 (27.3)	.185
No	187 (82.4)	40 (17.6)	
Transcript			
Yes	5 (62.5)	3 (37.5)	.162
No	206 (82.4)	44 (17.6)	
Thank you sent			
Yes	127 (87.6)	18 (12.1)	.008
No	79 (74.5)	27 (25.5)	
Red Flags (N = 71)			
Yes	0 (0)	4 (100)	<.001
No	63 (94.0)	4 (6.0)	
Leave of absence			
Yes	1 (5.9)	16 (94.1)	<.001
No	210 (86.4)	33 (13.6)	
USMLE Step 1 failing score			
Yes	7 (53.8)	6 (46.2)	.020
No	203 (82.5)	43 (17.5)	
USMLE Step 2 failing score			
Yes	37 (74.0)	13 (26.0)	.130
No	174 (83.3)	35 (16.7)	
Filler rank (median, IQR)	54 (26,74)	67 (49,81)	.064
Interview score (median, IQR)	3.5 (3,4)	3.5 (3,4)	.189

MD, doctor of medicine; *DO*, Doctor of Osteopathic Medicine; *USMLE*, United States Medical Licensing Examination; *IQR*, interquartile range.

analysis revealed that failure to transmit transcripts during the ERAS process and prior non-healthcare experience had no bearing on negative outcomes in residency. While we expected there to be an association between negative outcomes in residency and "red flags" during the EM clerkship, the negative associations related to prior heathcare experience was an unexpected finding, as our program looks upon prior experience as a positive applicant attribute. The negative association with a failure to send a thank-you note after the interview was also an unexpected finding.

While a failing grade on the USMLE Step I exam was associated with negative outcomes during training this does not seem to be an unexpected finding, as individuals who had medical knowledge deficits in medical school would intuitively seem to be more likely to require a formal remediation plan (termed a LoD at UConn) during residency, similar to the findings of Wagner et al.[10] We found that D.O.s had a decreased chance of having negative outcomes in our residency, but this finding may be due to selection bias given the relatively small number of D.O.s in our program.

Table 3. Predicting composite measure of negative outcomes: simultaneous logistic regression.

Predictor	Odds ratio (OR)	(95% CI for OR)	P value
Sending thank you note	3.16	1.44 – 6.91	0.004
Leave of absence	98.05	11.62 – 827.71	< 0.001
USMLW Step I failing score	1.44	0.28 – 7.46	.662
Prior career in health	2.064	0.91 – 4.678	.082

Similarly, while IMG status did not confer a statistically significant chance of negative outcomes during residency, a relatively small number of IMGs were present in our dataset. Areas for further study include more detailed analysis of clerkship grades, medical school class rank and the rank of the applicant's medical school. Other studies have found that IMGs have a lower rate of residency completion.[11]

LIMITATIONS

This study was a retrospective analysis of the applicant data of matriculated residents at a single EM residency program and may not be generalizable to other EM residencies or other specialties. The dataset was also limited in certain respects due to some USMLE Step scores only being recorded as pass or fail. This pass/fail scoring prevented us from analyzing a delta between each of the tests to determine whether improvement or worsening of board scores between the steps was significant. Analysis of USMLE scores was also limited by the fact that while most residents had these scores recorded, some osteopathic residents had only sat for the Comprehensive Osteopathic Medical Licensing Examination.

Furthermore, the lack of standardization of medical school grades and reporting of medical school class rank was also problematic. The lack of a universal presence of Alpha Omega Alpha (AOA) chapters at allopathic medical schools or Sigma Sigma Phi at osteopathic medical schools precluded analysis of nomination as an attribute. The lack of an objective measure of ranking medical schools themselves did not give us an objective measure by which to assess a correlation between medical school reputation and resident outcomes.

CONCLUSION

Our analysis revealed that "red flags" during emergency medicine clerkships, a leave of absence during medical school for any reason and failure to send post-interview thank-you notes were all associated with negative outcomes during a three-year emergency medicine residency.

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A Randomized Trial of SMART Goal Enhanced Debriefing after Simulation to Promote Educational Actions

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Introduction: Goal setting is used in education to promote learning and performance. Debriefing after clinical scenario-based simulation is a well-established practice that provides learners a defined structure to review and improve performance. Our objective was to integrate formal learning goal generation, using the SMART framework (Specific, Measurable, Attainable, Realistic, and Time-bound), into standard debriefing processes (i.e., "SMART Goal Enhanced Debriefing") and subsequently measure the impact on the development of learning goals and execution of educational actions.

Methods: This was a prospective multicenter randomized controlled study of 80 emergency medicine residents at three academic hospitals comparing the effectiveness of SMART Goal Enhanced Debriefing to a standard debriefing. Residents were block randomized on a rolling basis following a simulation case. SMART Goal Enhanced Debriefing included five minutes of formal instruction on the development of SMART learning goals during the summary/application phase of the debrief. Outcome measures included the number of recalled learning goals, self-reported executed educational actions, and quality of each learning goal and educational action after a two-week follow-up period.

Results: The mean number of reported learning goals was similar in the standard debriefing group (mean 2.05 goals, SD 1.13, *n*=37 residents), and in the SMART Goal Enhanced Debriefing group (mean 1.93, SD 0.96, *n*=43), with no difference in learning goal quality. Residents receiving SMART Goal Enhanced Debriefing completed more educational actions on average (Control group actions completed 0.97 (SD 0.87), SMART debrief group 1.44 (SD 1.03) *p*=0.03).

Conclusion: The number and quality of learning goals reported by residents was not improved as a result of SMART Goal Enhanced Debriefing. Residents did, however, execute more educational actions, which is consistent with the overarching intent of any educational intervention. [West J Emerg Med. 2018;19(1)112–120.]

INTRODUCTION

In education, a critical step facilitating the transfer of lessons learned into practice is creating action plans or setting learning goals.[1,2] While goals are not always accomplished, there is a clear relationship between setting goals and achievement.[3,4] Goals can influence performance by focusing effort and attention to a specific domain resulting in greater effort and persistence of effort, as well as strategies to approach tasks.[3-5] An established

model for developing actionable learning goals is the "SMART" framework. These goals are Specific, Measurable, Attainable, Realistic, and Time-bound. The SMART framework is easy to teach, easy to remember, and has been employed successfully across multiple disciplines, including medical education.[6-12] Ideally, SMART goals consist of practical, concrete actions that learners plan to implement to improve their knowledge, skills, and attitudes, with an emphasis on tangible outcomes.[7,9,13]

It is commonly held that residents will form learning goals without prompting and then execute them; however, this assumption is untested. While formal goal-setting instruction improves the quality of resident-generated learning goals, learners may struggle to independently create high-quality goals due to problems inherent in self-assessment.[14-17] However, the practice of self-assessment has been shown to generate a greater number of learning goals, and these goals are more likely to be carried out.[8,18]

As an educational platform in healthcare, simulation-based medical education (SBME) lends itself as a strategy for pairing informed self-assessment and targeted goal setting. SBME employs well-structured, guided debriefing sessions incorporating formative feedback to impact performance.[19-23] Debriefing strategies are designed to engage learners through a reflective conversation using objective feedback and self-assessment, thereby providing the context to change suboptimal practice patterns and improve patient outcomes.[24] However, all debriefing techniques do not incorporate the generation of explicit learning goals.[25] The use of debriefing in SBME as a vehicle to impact educational outcomes by providing informed self-assessment in conjunction with explicit goal-setting warrants further study.

The objective of our study was to compare the effectiveness of a novel debriefing modality that integrated the creation of quality, self-directed learning goals identified from a clinical simulation scenario, compared to a standard simulation debriefing without explicit dialogue about learning goals. We hypothesized that this "*SMART Goal Enhanced Debrief*" would result in the completion of a greater number and higher quality of learning goals and educational actions.

Population Health Research Capsule

What do we already know about this issue?
Goals help to promote learning and performance. The "SMART" (Specific, Measurable, Attainable, Realistic, Time-bound) framework for setting goals has been successfully used across multiple disciplines including medicine.

What was the research question?
To evaluate the effectiveness of a SMART Goal Enhanced Debriefing strategy after simulation.

What was the major finding of the study?
SMART Goal Enhanced Debriefing stimulated additional self-directed learning through executed educational actions.

How does this improve population health?
Improving debriefing methodology after simulation has the potential to reach a wide variety of learners across the healthcare continuum.

METHODS

Study Design

This was a prospective multicenter randomized controlled study comparing the effectiveness of a standard debriefing process to SMART Goal Enhanced Debriefing, which employed the use of coaching to develop "SMART" learning goals.[9] Learners participated in a high-fidelity, mannequin-based clinical simulation scenario followed by formal debriefing with one of two methods. Measured outcomes included both the generation of learning goals and the subsequent completion of educational actions. The study was approved by each institution's local institutional review board and classified as exempt at each site (i.e., informed consent was not required in accordance with standard educational practices).

Study Setting and Sample

The study was conducted at three academic hospitals from November 2013 to March 2014, each supporting Accreditation Council for Graduate Medical Education approved residencies in emergency medicine (EM). Attributes include one Midwest urban university affiliated site with an annual emergency department (ED) census of 110K visits (Site1); one Mid-Atlantic suburban university affiliated site with an ED volume of 115K visits (Site 2); and one Northeast private urban site with an annual ED census of 120K visits (Site 3). Respectively, each site supports nine EM residents/year, 12 EM or combined program EM/family practice or EM/internal medicine residents/year, and 16 EM residents/year. Subjects included a convenience sample of EM residents or combined program residents. Participation in the study was voluntary, though residents were required at their respective institutions to routinely participate in simulation-based educational activities as part of general curricular requirements.

We determined necessary sample size based on estimated number of educational actions that would be reported in the control and intervention groups, based on the study team's previous experience in this area.[8] Initially, the need for 88 residents was predicted based on an estimate of 0.8 reported actions in the control group, and 2.0 in the intervention group

(standard deviation [SD] 2, alpha 0.05, power 80%, enrollment ratio 1). We terminated enrollment early due to achieving statistical significance between the two groups.

Study Protocol

Simulation Case Scenarios

A schematic of the study protocol is graphically represented in Figure 1. Case scenarios were not standardized across institutions in order to model typical educational settings representing the variety of cases used for teaching. Recognizing that certain types of cases may lend themselves better as a stimulus for generating goals and actions, residents were block randomized by case at each site. The priority of randomization was to have a similar spread of cases across both groups. Program administrators did appropriately match resident postgraduate year (PGY) level to specific case scenarios and associated learning objectives in advance. Cases at each site involved the participation of two or three residents. Residents were enrolled only once and were blinded to their assigned group.

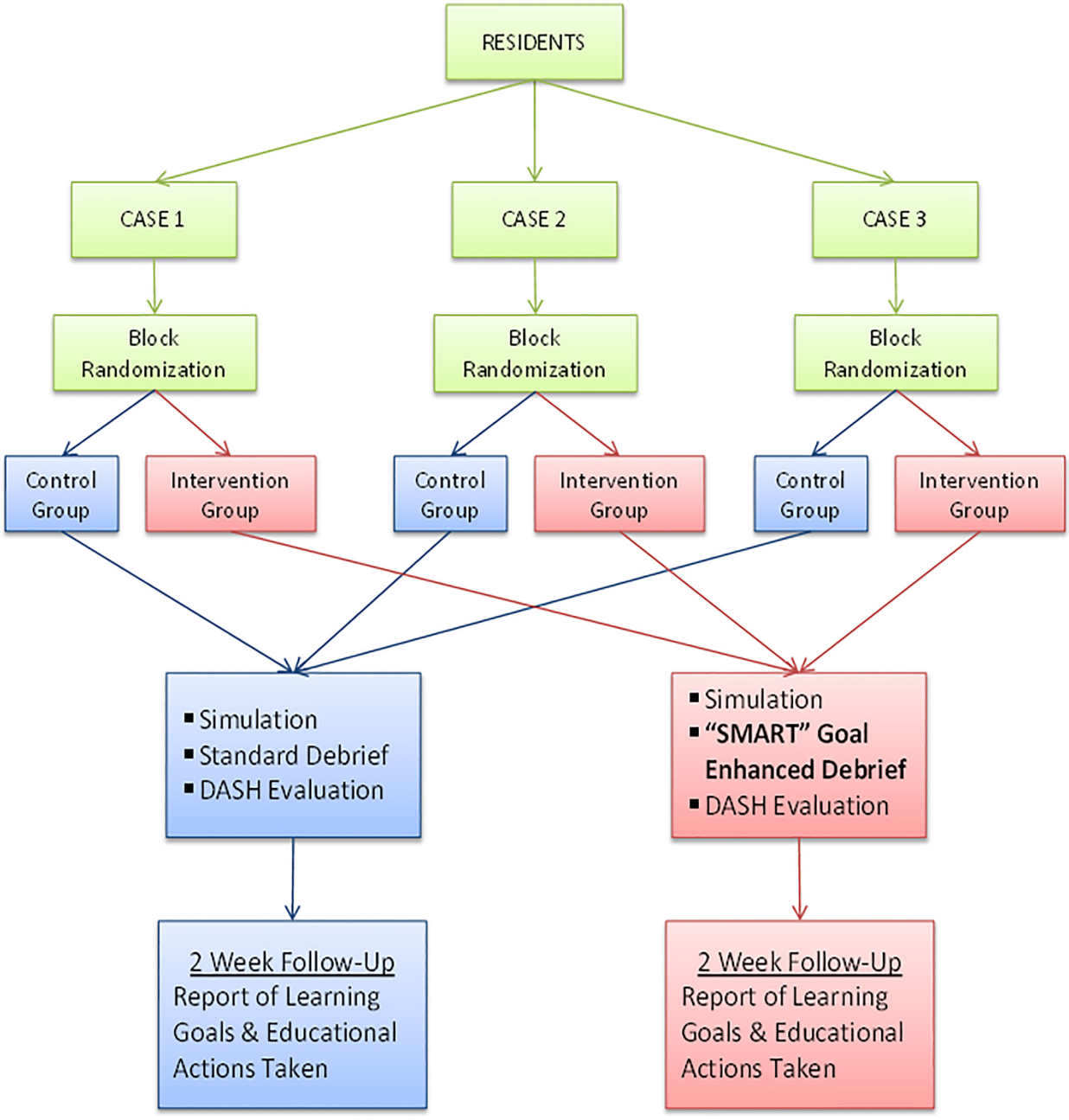

Figure 1. Schematic of study protocol comparing development of learning goals.

Debriefing

After completing the simulation, residents received approximately 30 minutes of debriefing time structured as a standard debrief (control group), or a SMART Goal Enhanced Debrief, which embedded five minutes of formal instruction and development of SMART learning goals (intervention group). Of note, the length of time for case scenarios and debriefing were constrained by each site's curricular structure, and thus any individual group did not receive any more or less instruction time in total. Residents were asked to keep scenario details confidential to allow cases to remain novel for future participants.

EM academic faculty members with experience in simulation debriefing facilitated the simulation sessions. Faculty members were not limited to members of the study team or participation in either the control or intervention groups. However, to minimize the effect of varying debriefing styles each facilitator was trained to assure that each debriefing session was conducted in a well-accepted and structured format consisting of three phases: reactions, analysis/reflection, and summary/application (Appendix 1).[24] It is important to note that facilitators would still routinely discuss lessons learned and next steps in the summary/application phase of the debrief as part of standard practice in the control group. The enhancement of this practice in the intervention group specifically related to coaching and writing down goals in the SMART format during this final debriefing phase.

SMART Goal Enhanced Debriefing

In the intervention group, education around the development of SMART learning goals was conducted in the summary/application phase of the debriefing to facilitate linking lessons learned from the case to explicit goals. Faculty instructors guided residents to generate SMART learning goals in response to the simulation, using a standardized worksheet that defined SMART learning goals with examples (Appendix 2). Residents were allowed to keep the worksheet after the debriefing.

Evaluation of Debriefing

At the conclusion of each debriefing session, residents were asked to complete the Debriefing Assessment for Simulation in Healthcare (DASH) for the purpose of monitoring the overall quality of SBME sessions in both study groups. Residents were given the "DASH – Student Version Short Form," which is designed for learners to rate their instructors in each of the six core DASH elements in less than three minutes.[26] Content validity of the DASH has its basis in best debriefing practices defined by an expert panel grounded in an extensive literature review.[27]

Measurements

The primary outcome was to compare the number and quality of learning goals and educational actions recalled after a two-week follow-up interval by residents after standard debriefing (control group) to the learning goals and educational actions recalled by resident's who underwent SMART Goal Enhanced Debriefing (intervention group). Specifically, all residents were asked to list learning goals and educational actions taken in response to their simulation case encounter (Appendix 3). A two-week time interval was chosen because the study team felt that it would be unlikely for educational actions to be executed beyond that time frame. Additionally, minimizing the follow-up period would help limit recall bias.

Learning Goal Rating Scale – Validity Evidence

Initially, we rated the quality of learning goals using a scoring rubric with validity evidence published by Lockspeiser,[28] which was subdivided into domains based in the "I-SMART" mnemonic (i.e., important, specific, measureable, etc.). Unfortunately, raters in this study could not reliably apply Lockspeiser's rubric to the recalled goals submitted by our cohort of learners. As a result, we created a modified Learning Goal Rating Scale (Figure 2). To support content validity, we adapted Lockspeiser's original anchors that uniquely related to the "SMART" criteria within the context of our learning-goal worksheet. Response process was improved through an iterative process of rater training and tool refinement. Developing general scoring guidelines and streamlining the tool into a single global rating scale decreased variation in interpreting the anchors.

Internal structure of the Learning Goal Rating Scale was supported by measuring an intraclass correlation coefficient (ICC), using a two-way model estimating the reliability of average κ ratings. Upon finalizing the structure of the Learning Goal Rating Scale, four members of the study team used it to independently rate a representative subset of learning goals (n=21) with good reliability (ICC=0.82). Once this initial reliability was established, the same four members of the study team applied the Learning Goal Rating Scale to every reported learning goal (n=155). We found that good reliability was maintained (ICC=0.78). The Learning Goal Rating Scale was not tested for relationships to other variables or consequences.

Educational Action Rating Scale – Validity Evidence

We measured the quality of the educational actions using an Educational Action Rating Scale (Figure 2). It was developed de novo as there was no existing instrument for this purpose. To support content validity, we chose rating criteria based on principles of education pedagogy such as the cognitive domain of Bloom's Taxonomy.[29,30] In essence, higher ratings would be given to activities that incorporated active learning and were deemed more relevant to clinical practice. Furthermore, given that the amount of time spent engaged in a learning activity correlates with educational impact, duration of the activity would also result in an improved rating. To support response process validity, the instrument was piloted and revised using an iterative process to simplify the interpretation of specific rating criteria. Initially, four members

Learning Goal Rating Scale

Please rate each learner reported learning goal using bulleted criterion based on the "SMART" framework. The three tiers of bulleted criterion for a given scoring range should be interpreted as characteristics of goals along a spectrum of scores ranging from 0 to 5, with 0 representing all criterion in the leftward column, and 5 representing all criterion in the rightward column.

• No or minimal relevance to educational encounter • Vague descriptors (ex - more comfortable or more knowledgeable) • Impractical use of time and resources	• Planned activity is evident, but not precisely described (ex – uses verbs like understand, learn, know, list, describe, explain). • Achievable/realistic outcome anticipated, but limited by modest scope of clinical impact. • Time frame not explicitly defined (ex- soon, right away).	• Uses action words (NOT understand, learn, know, describe). • Clear and measurable outcomes. • Appropriate use of resources, and conventional time descriptors (ex – days, weeks, months).

0	1	2	3	4	5

Educational Action Rating Scale

Please rate each learner reported educational action in the context of their simulation based learning activity. The three tiers of bulleted criterion below represent characteristics of actions along a spectrum of scores ranging from 0 to 5, with 0 fulfilling all criterion in the leftward column, and 5 fulfilling all criterion in the rightward column.

• No action/Minimally relevant • Minimal time spent	• Understanding oriented, reading • Some time spent	• Clinically Oriented, behavior modification, "doing" • Significant time spent

0	1	2	3	4	5

Figure 2. Learning goal and educational action rating instruments.

of the study team rated a representative subset of educational actions from our cohort (n=18) with good ICC (0.86). At three months, excellent test-retest reliability was demonstrated on the same subset of educational actions (ICC=0.94). Follow-up ratings of every educational action (n=95) by the same four raters revealed good ICC (0.90). The Educational Action Rating Scale was not tested for relationships to other variables or consequences.

Average Quality Ratings

Learning goal and educational action ratings were performed by four study investigators blinded to study site and group (control or intervention). Each study investigator rated the quality of reported goals and actions for all study subjects. We created the Average Learning Goal Quality by averaging ratings of learning goals within each study group. The Average Educational Action Quality was calculated in a similar manner.

Data Analysis

We evaluated sampling distribution of simulation cases using a chi-squared test, or Fisher's exact test when the case frequency was <5 in any group. A p value of <0.05 was considered significant. We used descriptive statistics to summarize the number and quality of goals and educational actions. The number and quality of learning goals and educational actions from the control and intervention groups were compared using a t-test. We summarized DASH results with descriptive statistics and applied t-tests to determine statistically significant differences in the delivery of SBME sessions between groups. A $p < 0.05$ level was considered significant.

RESULTS

A total of 80 residents were enrolled in the study: 37 in the standard debriefing (control) group, and 43 in the SMART Goal Enhanced Debriefing (intervention) group. A breakdown of the PGY level of study subjects in each group and site are detailed in Tables 1 and 2. Table 3 lists simulation case scenarios, their frequency of utilization, and a statistical measure of randomization.

Residents in the standard debriefing group (n=37) recalled a total of 76 learning goals and subsequently reported 36 educational actions performed. Residents in the SMART Goal Enhanced Debriefing group (n=41) recalled 79 goals and reported 59 actions performed. Two PGY1 residents in the SMART Goal Enhanced Debriefing group were lost to follow-up at Site 3 (did not return/submit their learning goals and action items).

Table 1. Subjects in the standard debriefing group.

Residents	Site 1	Site 2	Site 3	Total
PGY1	3	3	6	12
PGY2	5	3	4	12
PGY3	4	3	4	11
PGY4	0	2	0	2
PGY5	0	0	0	0

PGY, post graduate year.

Table 2. Subjects in the SMART Goal Enhanced Debriefing group.

Residents	Site 1	Site 2	Site 3	Total
PGY1	6	5	7	18
PGY2	4	5	5	14
PGY3	3	2	4	9
PGY4	0	0	0	0
PGY5	0	2	0	2

PGY, post graduate year; *SMART*, specific, measurable, attainable, realistic and time-bound.

The mean number and quality of learning goals recalled and educational actions reported are detailed in Table 4. There was no significant difference in the mean number of goals reported or goal quality; however, residents receiving SMART Goal Enhanced Debriefing completed more educational actions on average (p=0.03). There was no difference in action quality.

We reviewed the DASH ratings of the simulation sessions in both groups to ensure that the quality of debriefing was similar in both groups. Both were rated similarly across all measured domains (Table 5).

DISCUSSION

The ability to efficiently engage in goal-oriented, self-directed learning has the potential to serve as a scaffold for ongoing performance improvement over the entirety of a physician's career. Widespread application of deliberate goal setting should be considered an important skill to promote ongoing professional development. In this study, SBME motivated residents to set learning goals after both standard debriefing as well as SMART Goal Enhanced Debriefing. Residents did not generate more learning goals as a result of receiving SMART Goal Enhanced Debriefing. Notably, residents from this group reported performing more educational actions, which is arguably the more important metric related to improving one's clinical performance.

We theorize that the *process* of creating SMART learning goals served as a subconscious primer for the *execution* of goals. Priming is thought to improve the likelihood of one's acting on a goal by increasing motivation, focus, and commitment.[3,31] Concurrently, automatic goal activation can be influenced by associations with situational features and mental representations of colleagues' goal pursuits.[32] Both of these factors likely came into play in our study. For example, a key situational feature was the explicit use of SMART learning-goal worksheets, while debriefing with peers and instructors provided external mental representations of the goals of others.

Other educational factors may also have worked in combination, or even synergistically, to promote the execution of goals. For example, all simulation debriefings in our study used the technique of summarizing lessons learned in relation to observed performance. When explicitly linked with the development of learning goals, this technique may have served as a powerful stimulus to promote the completion of subsequent learning activities.[5] Further codifying learning goals into the structured SMART framework may also have stimulated ongoing motivation such that even more actions were completed in the intervention group. Theoretical constructs in goal-setting supporting motivation include improving affect (i.e., feels good to achieve a goal); metacognition (i.e., stimulation of task strategies for goal attainment); and choice (i.e., learner-centered goals are more likely to be pursued).[4,5]

Table 3. Clinical simulation case scenarios and frequency.

Simulation case scenario title	Standard debriefing frequency (*n*)	Goal enhanced debriefing frequency (*n*)	*p* value
Torsades	12	13	0.90
Bradycardia	6	6	0.82
Neuroleptic malignant syndrome	2	2	0.64
Unstable tachycardia	2	4	0.40
Hepatic encephalopathy	1	2	0.55
TCA overdose	1	1	0.72
Methanol toxicity	1	2	0.55
Cognitive error – right ventricular infarct	3	2	0.44
Placental abruption	2	6	0.18
Symptomatic bradycardia calcium channel blocker overdose	1	1	0.72
Penetrating neck trauma	3	0	0.10
Penetrating chest trauma	3	0	0.10
Carbon monoxide toxicity	0	2	0.30
Traumatic subarachnoid hemorrhage	0	2	0.30

TCA, tricyclic antidepressant.

Table 4. Mean and standard deviation of number and quality of learning goals and educational actions.

	Number of learning goals*	Average learning goal quality†	Number of educational actions*	Average educational action quality†
Standard debriefing (*n* = 37)	2.05 (1.13)	2.84 (0.88)	0.97 (0.87)	2.88 (0.89)
SMART-goal enhanced debriefing (*n* = 41)	1.93 (0.96)	2.88 (0.81)	1.44 (1.03)	3.01 (0.91)
p value	0.59	0.76	0.03	0.52

SD, standard deviation; *SMART*, specific, measurable, attainable, realistic, time-bound.
*mean per resident / SD
† mean / SD

Table 5. Mean and standard deviation of resident "DASH" ratings (Debriefing Assessment in Healthcare). Ratings are all reported on a scale of 1 to 7 (1=extremely ineffective, 7=extremely effective).

Individual DASH elements	Standard debriefing (*n* = 30)	SMART-goal enhanced debriefing (*n* = 35)	*p* value
Introduction to the simulation environment	5.9 (1.0)	6.1 (0.8)	0.34
Engaging context for learning	6.5 (0.7)	6.3 (0.8)	0.16
Organized debriefing structure	6.5 (0.6)	6.5 (0.7)	1
Provoked reflection of performance	6.4 (0.7)	6.5 (0.6)	0.34
Identified what was done well and poorly	6.0 (0.8)	6.2 (0.7)	0.44
Helped determine how to improve or sustain good performance	6.5 (0.6)	6.4 (0.7)	0.50

Regardless of the underlying mechanism, we believe that equipping learners with an *explicit* method to develop focused learning goals may help them become self-directed learners. This is particularly valuable in the context of SBME, which is a commonly employed educational technique across the healthcare continuum. Regardless of profession, simulation educators craft clinical cases and debriefing objectives tailored to their learners. Debriefing incorporates self-assessment and reflection as key components that impact the learning process. Building on this framework, improving a learners' ability

to create actionable learning goals will ultimately facilitate improvement in subsequent clinical performance. In our experience, instructors can become skilled at applying the SMART goal format in a short time period.

LIMITATIONS

There are several limitations to this study. We chose to study our intervention with non-standardized simulation case scenarios to replicate conditions in routine educational settings in the hopes of making our findings more generalizable. While we asked all residents to self-report their learning goals and actions approximately two weeks after the educational encounter, it is difficult to know if residents accurately represented these goals and actions in follow-up. There may be an effect of recall bias. Finally, novel measurement tools were developed in an effort to quantify the quality of goals and actions. We recognize that our interpretations cannot be "fully valid."[33] As a result, validity evidence was collected during the development of the measurement tools. This resulted in a process of refinement of a Learning Goal Rating Scale. Similarly, development of the Educational Action Rating Scale was developed de novo and has not been validated externally. The impact on study results are unknown.

CONCLUSION

We found that debriefing after simulation is an effective modality to stimulate the development of learning goals and the execution of educational actions. While the application of a simple goal-setting exercise (i.e., SMART Goal Enhanced Debriefing) did not increase the number and quality of goals recalled, it did serve as a powerful primer to promote additional self-directed learning through *executed* educational actions. This intervention can be readily applied to most simulation debriefing sessions and requires little training to be employed effectively.

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Do End-of-Rotation and End-of-Shift Assessments Inform Clinical Competency Committees' (CCC) Decisions?

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Introduction: Clinical Competency Committees (CCC) require reliable, objective data to inform decisions regarding assignment of milestone proficiency levels, which must be reported to the Accreditation Council for Graduate Medical Education. After the development of two new assessment methods, the end-of-shift (EOS) assessment and the end-of-rotation (EOR) assessment, we sought to evaluate their performance. We report data on the concordance between these assessments, as well as how each informs the final proficiency level determined in biannual CCC meetings. We hypothesized that there would be a high concordance level between the two assessment methods, including concordance of both the EOS and EOR with the final proficiency level designation by the CCC.

Methods: The residency program is an urban academic four-year emergency medicine residency with 48 residents. After their shifts in the emergency department (ED), residents handed out EOS assessment forms asking about individual milestones from 15 subcompetencies to supervising physicians, as well as triggered electronic EOR-doctor (EORd) assessments to supervising doctors and EOR-nurse (EORn) to nurses they had worked with after each two-week ED block. EORd assessments contained the full proficiency level scale from 16 subcompetencies, while EORn assessments contained four subcompetencies. Data reports were generated after each six-month assessment period and data was aggregated. We calculated Spearman's rank order correlations for correlations between assessment types and between assessments and final CCC proficiency levels.

Results: Over 24 months, 5,234 assessments were completed. The strongest correlations with CCC proficiency levels were the EORd for the immediate six-month assessment period prior (r_s 0.71-0.84), and the CCC proficiency levels from the previous six-months (r_s 0.83-0.92). EOS assessments had weaker correlations (r_s 0.49 to 0.62), as did EORn (r_s 0.4 to 0.73).

Conclusion: End-of-rotation assessments completed by supervising doctors are most highly correlated with final CCC proficiency level designations, while end-of-shift assessments and end-of-rotation assessments by nurses did not correlate strongly with final CCC proficiency levels, both with overestimation of levels noted. Every level of proficiency the CCC assigned appears to be highly correlated with the designated level in the immediate six-month period, perhaps implying CCC members are biased by previous level assignments. [West J Emerg Med.2018;19(1)121–127.]

INTRODUCTION

In the "Milestone Project" for assessing resident physicians' competencies,[1] the determination of milestone proficiency is the responsibility of the Clinical Competency Committees (CCC). To meet this obligation our CCC, composed of our core emergency medicine (EM) educational faculty, meets twice a year. It seeks to rely on objective measures to select one of the five levels of ascending proficiency that best represents each resident's individual performance during the preceding six months of training.[2] While suggested assessment methods are provided for each of the subcompetencies within an individual specialty's milestones,[3] there are no clear current best practices regarding which assessments are most likely to provide the most useful and valid data to CCCs in the determination of the proper proficiency level.

Previous reports have noted that end-of-shift (EOS) assessments, if used in isolation, yield falsely elevated proficiency levels.[4] Schott et al. failed to validate the results of direct observation using either a checklist tool or a milestone proficiency-level tool when used in video review of a critical patient encounter with varying levels of trainees. They cited significant issues with both rater error and instrument error.[5]

We developed a multi-modal milestone evaluation program geared at obtaining objective data for CCC usage. In this study we provide a description of the performance of the two predominant assessment methods used in this new milestone evaluation program: (1) the brief EOS assessment collected in paper form at the end of a shift after direct supervision; and (2) the end-of-rotation (EOR) global assessment collected in electronic form. We report data on the concordance between EOS and EOR assessments, as well as how each informs the final proficiency level determined in biannual CCC meetings. We hypothesized that there would be a high concordance level between the two assessment methods, including concordance of both the EOS and EOR with the final proficiency level designation by the CCC.

Population Health Research Capsule

What do we already know about this issue?
End-of-shift assessments are thought to provide artificially inflated grades when used to assess trainees, yet residency programs use them to provide information to Clinical Competency Committees (CCC).

What was the research question?
Is there concordance between end-of-shift and end-of-rotation assessments with each other and final proficiency levels assigned by the CCC?

What was the major finding of the study?
End-of-rotation assessments completed by supervising doctors are most highly correlated with final CCC proficiency level designations, while end-of-shift assessments overestimate levels.

How does this improve population health?
Providing valid assessment data to CCCs helps residency programs develop appropriate, targeted development and remediation to trainees, maximizing their patient outcomes.

METHODS

The study site is an urban academic institution, home to a four-year EM residency with 48 residents and 42 full-time faculty members across two large medical centers. Institutional review board approval was obtained. In short, the EOS assessment involved residents handing out individual assessment sheets comprised of 9-11 individual "milestone" questions, taken from 15 subcompetencies, to supervisory doctors after a shift. These pocket notebooks contained 10 sets of each 8-sheet assessment packet. Assessor identity was not tracked on the EOS. The EOR assessment allowed residents to electronically trigger an online assessment focused on global performance after two weeks of an emergency department (ED) rotation. The EOR for supervisory doctors (EORd) sent the full five levels of ascending proficiency from 16 subcompetencies for supervisory doctors and from four subcompetencies for nurses (EORn). Reports were run for both EOR and EOS assessments after each six-month period to calculate proficiency levels for each of the applicable subcompetencies, and information was provided to members of the CCC.

Similar to a grant review, each CCC member was assigned primary responsibility for up to six residents, reported a summary of the data after review, and suggested proficiency levels to the group. Final proficiency levels were determined after group discussion with guidance from the CCC leader. To determine correlations, aggregate data for the EORd, EORn, EOS, and final CCC proficiency levels were obtained for each of the four six-month time frames. We calculated Spearman's rank order correlations for correlations between assessment types and between assessments and final CCC proficiency levels. Correlations were considered "very strong" for $r_s > 0.8$, "strong" for r_s =0.6-0.79, "moderate for r_s = 0.40-0.59, "weak" for r_s = 0.20-0.39 and "very weak" for $r_s < 0.2$. We calculated p-values and used the Bonferonni correction to account for the many correlations, with p-values below 0.0005 considered statistically significant.

RESULTS

A total of 5,234 assessments were completed over 24 months. The EORd accounted for 1,330 assessments, the EORn accounted for 509, and the EOS accounted for 3,395. Table 1 presents the annual completion rates by each assessment type by resident year. Spearman's rank order correlations between the EOS and EOR assessments are reported in Table 2. Please note that each is aggregated and reported twice a year (December and May) and hence the designation of the month initial and year. For example, EOS.M14 indicates the EOS assessment for May 2014. Furthermore, the EOR assessments were reported separately for physicians and nurses, hence the designation end-of-rotation by doctor (EORd) and end-of-rotation by nurse (EORn).

As demonstrated in Table 2, the EOS and EOR assessments did not have strong correlations, with values ranging from -0.17 to 0.65. Taken within each corresponding timeframe (December or May of the same year), the correlations tended to be better overall. EOS assessments were more strongly correlated with EOR assessments performed by physicians as compared to those performed by nurses. The range of correlations between EOS and EOR performed by nursing was -0.17 to 0.54, while the range of correlations between EOS and EOR performed by physicians was 0.01 to 0.65. Table 3 shows the correlations between the EOR assessments performed by nurses and those performed by physicians.

The final assigned level of proficiency for each subcompetency (designated as CCC.XXX with the same month and year designation as above) is found to be best correlated with EOR assessments performed by physicians for that particular period (Table 4). For example, the CCC assessment for May 2014 (CCC.M14) had a very strong correlation with EOR data from doctors run in May 2015(EORd.M14) (r_s=0.85). Furthermore, the correlations between EOR assessments performed by physicians and the CCC proficiency level improved temporally up to that particular period. For example, the correlation between CCC.M14 and EORd.D13 was 0.7, and this value improved to 0.85 when correlated with EORd.M14. Similarly, for CCC.M15, the correlations were 0.46, 0.71, 0.81, and 0.84 with EORd.D13, EORd.M14, EORd.D14, and EORd.M15. The correlations of EOS assessments with CCC proficiency levels remain relatively

Table 1. End-of-rotation (EOR) and end-of-shift (EOS) assessment completion rates per resident/per year .

	PGY 1	PGY2	PGY 3	PGY 4
2014 EORd	6-10, median=9	12-18, median=16	14-19, median=18	14-22, median=21
2015 EORd	4-7, median=6	11-17, median=13	14-17, median=16	18-23, median=20
2014 EORn	4-8, median=6	8-12, median=10	10-14, median=12	12-18, median=18
2015 EORn	3-6, median=5	6-11, median=9	9-13, median=11	7-11, median=10
2014 EOS	28-56, median=40	15-76, median=47	18-87, median=34	17-59, median=36
2015 EOS	8-57, median=25	13-53, median=36	12-55, median=38	10-38, median=25

EOS, end of shift; *EORd*, end of rotation (doctor); *EORn*, end of rotation (nurse); *PGY*, post graduate year.
Completion rates are per resident/per year listed by min-max, median.

Table 2. Correlation table of end-of-rotation assessments by nurses and doctors vs. end-of-shift assessments for 24 months.

	EORd.D2013		EORd.M2014		EORd.D2014		EORd.M2015	
EOS.D2013	0.49	p<0.0005*	0.56	p<0.0005*	0.65	p<0.0005*	0.65	p<0.0005*
EOS.M2014	0.38	p<0.0005*	0.47	p<0.0005*	0.63	p<0.0005*	0.62	p<0.0005*
EOS.D2014	0.12	p=0.02	0.14	p=0.003	0.61	p<0.0005*	0.58	p<0.0005*
EOS.M2015	0.01	p=0.93	0.07	p=0.21	0.34	p<0.0005*	0.45	p<0.0005*
	EORn.D2013		EORn.M2014		EORn.D2014		EORn.M2015	
EOS.D2013	0.37	p<0.0005*	0.52	p<0.0005*	0.48	p<0.0005*	0.39	p<0.0005*
EOS.M2014	0.29	p<0.0005*	0.36	p<0.0005*	0.46	p<0.0005*	0.3	p<0.001
EOS.D2014	0.1	p=0.06	0.29	p=0.001	0.54	p<0.0005*	0.27	p<0.000
EOS.M2015	-0.17	p=0.18	0.20	p=0.08	0.34	P=0.001	0.39	p<0.0005*

EOS, end of shift; *EORd*, end of rotation (doctor); *EORn*, end of rotation (nurse); *D*, December; *M*, May.
Using Bonferonni correction, p values less than 0.0005 are considered statistically significant and have been designated with an asterisk (*)

Table 3. Correlation table of EORn versus EORd for 24 months.

	EORn.D2013		EORn.M2014		EORn.D2014		EORn.M2015	
EOS.D2013	0.57	p<0.0005*	0.31	p<0.0005*	0.52	P=0.0008	0.31	p=0.48
EOS.M2014	0.48	p<0.0005*	0.51	p<0.0005*	0.59	p<0.0005*	0.37	p=0.64
EOS.D2014	0.61	p<0.0005*	0.51	p<0.0005*	0.7	p<0.0005*	0.67	p<0.0005*
EOS.M2015	0.4	p=0.48	0.59	p<0.0005*	0.7	P=0.001	0.65	p<0.0005*

EOS, end of shift; *EORd*, end of rotation (doctor); *EORn*, end of rotation (nurse); *D*, December; *M*, May.
Using Bonferonni correction, p values less than 0.0005 are considered statistically significant and have been designated with an asterisk (*)

Table 4. Correlation table of EOS and EOR versus final CCC assigned level of proficiency.

	EOS.D2013	EOS.M2014	EOS.D2014	EOS.M2015
CCC.D2013	0.49			
CCC.M2014	0.51	0.53		
CCC.D2014	0.57	0.62	0.6	
CCC.M2015	0.53	0.59	0.58	0.49
	EORd.D2013	EORd.M2014	EORd.D2014	EORd.M2015
CCC.D2013	0.71			
CCC.M2014	0.7	0.85		
CCC.D2014	0.54	0.77	0.84	
CCC.M2015	0.46	0.71	0.81	0.84
	EORn.D2013	EORn.M2014	EORn.D2014	EORn.M2015
CCC.D2013	0.53			
CCC.M2014	0.5	0.56		
CCC.D2014	0.47	0.55	0.73	
CCC.M2015	0.4	0.54	0.68	0.64

CCC, clinical competency committee; *EOS*, end of shift; *EORd*, end of rotation (doctor); *EORn*, end of rotation (nurse); *D*, December; *M*, May.
Using Bonferonni correction, p values less than 0.0005 are considered statistically significant.
Blank areas represent data not available for correlated CCC.

weak, ranging from 0.49 to 0.62. Similarly, the correlations of EOR assessments performed by nurses had modest correlations with CCC proficiency levels, ranging from 0.4 to 0.73.

Looking at the CCC correlations in Table 5 across time, each CCC level of proficiency is very strongly correlated with the assigned CCC proficiency level in the previous time period. For example, the final CCC proficiency level from May of 2015 (CCC.M15) was very highly correlated with the final CCC proficiency level from the previous December in 2014 (CCC. D14) with a value of 0.92. In particular, CCC levels are highly correlated within a given academic year, somewhat less so across academic years, with diminishing association over time.

Across post-graduate year levels (PGY) 1 through 4, we noticed that correlations between the CCC proficiency levels and EORd by physicians were the highest (range 0.74-0.85), compared to CCC proficiency levels correlated with EOS and EORn (Table 5). P-values are less than 0.00001 unless otherwise indicated.

Looking at correlations across various subcompetencies in Table 6, we noted that whenever multiple data sources (EORd, EOS, and EORn) were used to assess an individual subcompetency, the correlation for the CCC proficiency levels across all of these subcompetencies was highest with the EORd compared to the two other data sources. We also noted that the correlations between CCC level of proficiency and EOR assessments by nurses are moderately strong in the four applicable subcompetencies that were chosen with r_s=0.66, 0.71, 0.65, and 0.57 for multi-tasking, patient-centered communication, team management and professional values (compassion, integrity), respectively.

DISCUSSION

The development and use of assessment tools for trainee assessment is a critical function of all residency training programs. The development of formal CCCs forced programs to re-evaluate their assessment methods and to determine whether

Table 5. Correlation table of final CCC proficiency levels over time.

	CCC.D2013	CCC.M2014	CCC.D2014	CCC.M2015
CCC.D2013	1.00	0.94	0.78	0.71
CCC.M2014	0.94	1.00	0.83	0.76
CCC.D2014	0.78	0.83	1.00	0.92
CCC.M2015	0.71	0.76	0.92	1.00

CCC, clinical competency committee; *D*, December; *M*, May.
Using Bonferonni correction, p values less than 0.0005 are considered statistically significant.

the information being collected was both reliable and valid for use in the determination of proficiency levels for residents, at each stage of training.

Predictors of Final Recommended CCC Proficiency Level by Assessment Type

While many EM residency programs, including ours, use the EOS assessments that are publicly available via the Council of Residency Emergency Medicine Residency Directors (CORD-EM) website,[6] the literature calls into question the use of this type of assessment. Warrington et al. (the original developers of the forms available on the CORD-EM site) published results noting only slight to fair inter-rater agreement in a video- based study in which educators at a national conference scored a "resident encounter" using the EOS form.[7] Another study of EOS assessments, although completed electronically, is described by Dehon et al. in the literature and reports that their EOS assessments in EM yielded inflated proficiency levels when used in isolation and when compared to the final CCC recommended proficiency level.[4] Our findings corroborate this notion, as we found that EOS assessments were not strongly correlated with final CCC proficiency levels, yielding significantly inflated proficiency levels when compared to the final rankings.

In our study, what mattered most for the final recommended proficiency level by the CCC was the EOR assessment performed by doctors (EORd) for that particular immediate six-month period preceding the assessment, as well as the preceding six months. This correlation spanned across each PGY level, with EORd consistently having the strongest correlation in comparison to EOS or to EOR assessments completed by nurses (EORn). Over time, the strongest correlation of the final recommended proficiency level was found to be the immediate preceding proficiency level assigned by the CCC. In our CCC meetings, previous proficiency levels were available both during pre-review of the resident data, as well as during the discussion of current assignments. Given this finding, it may be prudent to withhold this information in future meetings to see whether or not the CCC members are biased by prior data.

In discussing the weak correlation between the final CCC-assigned proficiency levels and EOS assessments, Dehon et al. commented that their overestimation was likely related to a lack of "No" responses by faculty and re-calculated proficiency levels after including "N/A" as a "No" response,[4] which allowed for a slightly increased differentiation across PGY level. At our program, we also noticed a paucity of "No" replies. This was thought to be related to faculty concern regarding the stigma associated with "No," especially in that EOS assessments were suggested for use as a discussion point with the residents at the end of the shift. Therefore, we chose to modify our answer scale to non-dichotomous choices, allowing for a "Progressing" option, placed between a newly titled "Consistently Demonstrating" to replace "Yes" and "No," which was replaced with an "Emerging" option. We chose "Emerging" as an attempt to remove the stigma associated with "No." We allowed an "NA" option. Unlike Dehon, our rate of "No" or "Emerging" was unchanged (average rate 1.5%; range 0.6% -2.4%), with few faculty choosing this option regardless of the terminology used to describe it. We did, however, note a significant decrease in both the use of the "N/A" option, as well as in "Yes" or the newly titled "Consistently Demonstrating," with an average usage of "Consistently Demonstrating" of 83.1% compared to 96.7% of "Yes" in the first year of the program. The "Progressing" option is responsible for the entirety of this difference. Despite this change, we noted no increase in the correlation of the EOS assessments with the final CCC proficiency level.

In evaluating EOR assessments, Kuo et al.[8] described the use of a milestone-based evaluation system in a surgery residency program in which global assessments using selected subcompetencies were sent out at the end of resident rotations. The authors found that EOR assessments yielded an increased distribution of possible scores across PGY levels, with evaluators using a wider range of the scale, including the lower proficiency levels. This was compared to their traditional Likert scale assessments, in which the median composite PGY1 score was 3.63 on a 1-4 scale, in comparison to 1.88 (proficiency levels 1-4) in their new milestone-based system.

Similar to the findings of Kuo et al., our study demonstrated that our program's EOR assessments, namely by doctors, reflected an increased distribution of scores, perhaps reflected in their higher correlations seen with our EOR and CCC proficiency levels. It is possible that the CCC may have found the EORd assessment to be more credible than other assessments and was biased towards considering these results more favorably. However, given the summative nature of

Table 6. Correlated CCC proficiency levels across PGY levels and subcompetencies.

	CCC_EORd	CCC_EOS	CCC_EORn
PGY1	0.815	0.56	0.59
PGY2	0.83	0.49	0.57
PGY3	0.85	0.49	0.515
PGY4	0.74	0.52	0.71
ICS1	0.8	0.59	0.66
ICS2	0.81	0.57	0.71
MK			
PBLI			
PC1	0.85	0.64	
PC10	0.70		
PC11	0.72		
PC12			
PC13	0.83		
PC14	0.83		
PC2	0.83	0.51	
PC3	0.86	0.72	
ICS1	0.8	0.59	0.66
ICS2	0.81	0.57	0.71
MK			
PBLI			
PC1	0.85	0.64	
PC10	0.70		
PC11	0.72		
PC12			
PC13	0.83		
PC14	0.83		
PC2	0.83	0.51	
PC3	0.86	0.72	

CCC, clinical competency committee; *EOS*, end of shift; *EORd*, end of rotation (doctor); *EORn*, end of rotation (nurse); *ICS,* interpersonal and communication skills; *MK,* medical knowledge; *PBLI,* practice-based learning and improvement; *PC,* patient care; *PROF,* professionalism; *SBP,* system-based practice.
Using Bonferonni correction, p values less than 0.0005 are considered statistically significant.
Blank areas represent areas where the subcompetencies were not evaluated by the data source.
Average correlations across 24 months.
P-values were not calculated.

both a global rating form and the milestones, it is perhaps not surprising that this is where we found the highest correlation.

Assessment Tools Inter-Correlations

In addition to not correlating well with the CCC proficiency levels, we also found that the EOS assessments did not correlate well with their counterpart EOR assessments when compared by subcompetency. As our newly implemented evaluation program progressed, and perhaps due to continued re-education to nursing about the non-Likert scale of proficiency levels, EORn and EORd were more in line with each other. However, the EORn assessments continually yielded a more inflated overall score for residents than EORd. We found that nurses were highly resistant to assigning lower proficiency levels, even to PGY1 residents at the onset of the program. While our re-education did yield slightly lower overall scores on the whole, EORn assessments continued to rate residents quite higher on the proficiency scale. In general, the EORn assessment scores were felt to not be useful to CCC members in deciding on their final proficiency scores; however, all members felt the descriptive comments provided by nursing staff were invaluable in finding items for improvement and commendation. Given the Accreditation Council for Graduate Medical Education (ACGME) requirement for multiple assessors,[8] it may be prudent to use feedback from nurses for more formative feedback, as opposed to the EORn assessments used in this initial version of our program.

Correlations by Subcompetency

Our study found that whenever multiple data sources (EORd, EOS, and EORn) were used to assess an individual subcompetency, the correlation for the CCC proficiency levels across all of these subcompetencies was also highest with the EORd compared to the two other data sources.

EOS assessments had the highest correlation with final CCC proficiency levels in milestones from PC3 (Diagnostic Studies) and PC7 (Disposition), while the lowest correlations were seen in those from SBP1 (Patient Safety) and PROF2 (Accountability). There were no strong correlations for either of the Interpersonal and Communication subcompetencies (Patient Communication or Team Management), nor either of the Professionalism subcompetencies between EOS assessments and final CCC proficiency levels. We found this particular weak correlation surprising, given that direct observation should provide the best opportunity for accurate assessments of skills such as communication and professionalism. We suspect that the variety of a resident's clinical encounters during any given shift may contribute to these data. Due to this finding, we advocate that EOS assessments be used cautiously as individual data points reflecting a "snapshot" of competence and not representative of a trainee's global assessment, to ensure the data provided can capture multiple encounter opportunities.

LIMITATIONS

We collected our data at a single site using two main assessment tools. While the CCC had an increased number of data points available for use, it is possible that the format used by our CCC is not generalizable to other institutions. In addition, the EOS is a paper tool, which is not ideal. However,

we believe it is feasible to sustain use of the instrument as a paper tool if desired, as we have been using it now for over three years. Ideally, the tool would become an electronic assessment that would be completed in real time. We cannot infer how this would change the utility of the tool or its correlation to CCC levels.

In some instances, individual residents may have limited assessment data. Over the PGY1 year, our interns spend less than half of their year on ED rotations and some may have had minimal exposure during each individual six-month time period. Due to this variable pattern of resident schedules, as well as the small number of expected assessments over a single experience, we did not compare assessment data month to month, but rather over six-month periods. We felt this was not a significant limitation, given the data is being used for CCC discussions, which occur only every six months. Similarly, overall nursing data collected contributed to the smallest percentage of our individual assessment tools. However, we believe nursing assessments are an important component for trainee assessment, given the ACGME's requirement for multisource assessments by multiple evaluators, including professional staff.

Lastly, as residents are allowed to select faculty for the EORd assessments, it is possible that this self-selection has skewed our data. We did, however, note that our most "critical" faculty were frequently chosen and believe residents selected a wide variety of assessors over time. Any faculty is able to trigger and complete an assessment at any time in the electronic system.

CONCLUSION

In our single center study of assessing EM residents' milestone proficiency, the end-of-rotation (EORd) assessments completed by supervising physicians (attendings and senior residents) are the most highly correlated with the final CCC proficiency level designation, while end-of-shift (EOS) assessments and end-of- rotation assessments by nurses (EORn) did not correlate well with final CCC proficiency levels. Every level of proficiency the CCC assigned appears to be highly correlated with the designated level in the immediate six-month period, perhaps implying CCC members are biased by previous level assignments. Based on our study, we advocate that EOS assessments be used cautiously as individual data points reflecting a "snapshot" of competence and not representative of a trainee's global performance. Further studies are needed to determine the utility of the EOS for CCC use, and the effect of blinding of prior CCC-assigned proficiency levels on current proficiency level designation.

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Experience Within the Emergency Department and Improved Productivity for First-Year Residents in Emergency Medicine and Other Specialties

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Introduction: Resident productivity is an important educational and operational measure in emergency medicine (EM). The ability to continue effectively seeing new patients throughout a shift is fundamental to an emergency physician's development, and residents are integral to the workforce of many academic emergency departments (ED). Our previous work has demonstrated that residents make gains in productivity over the course of intern year; however, it is unclear whether this is from experience as a physician in general on all rotations, or specific to experience in the ED.

Methods: This was a retrospective cohort study, conducted in an urban academic hospital ED, with a three-year EM training program in which first-year residents see new patients ad libitum. We evaluated resident shifts for the total number of new patients seen. We constructed a generalized estimating equation to predict productivity, defined as the number of new patients seen per shift, as a function of the week of the academic year, the number of weeks spent in the ED, and their interaction. Off-service residents' productivity in the ED was analyzed in a secondary analysis.

Results: We evaluated 7,779 EM intern shifts from 7/1/2010 to 7/1/2016. Interns started at 7.16 (95% confidence interval [CI] [6.87 – 7.45]) patients per nine-hour shift, with an increase of 0.20 (95% CI [0.17 – 0.24]) patients per shift for each week in the ED, over 22 weeks, leading to 11.5 (95% CI [10.6 – 12.7]) patients per shift at the end of their training in the ED. The effects of the week of the academic year and its interaction with weeks in the ED were not significant. We evaluated 2,328 off-service intern shifts, in which off-service residents saw 5.43 (95% CI [5.02 – 5.84]) patients per nine-hour shift initially, with 0.46 additional patients per week in the ED (95% CI [0.25 – 0.68]). The weeks of the academic year were not significant.

Conclusion: Intern productivity in EM correlates with time spent training in the ED, and not with experience on other rotations. Accordingly, an EM intern's productivity should be evaluated relative to their aggregate time in the ED, rather than the time in the academic year. [West J Emerg Med. 2018;19(1)128–133.]

INTRODUCTION

Resident productivity in emergency medicine (EM) is an important educational and operational measure. The ability to continue seeing new patients throughout a shift is fundamental to an emergency physician's development, reflected in the multitasking (task-switching) milestone of EM training, and can be used as a means of evaluating an individual resident's progress and competency.[1] Specifically, the milestone charts a resident's progress from managing a single patient amid distractions, to being able to manage multiple patients, and eventually to managing the patient volume of the emergency department (ED) itself.[1] Having a robust and quantifiable means of measuring progress along this milestone would allow educators to identify residents who would benefit from early, targeted interventions to hone their strategy for managing patients and workflow. Operationally, understanding a resident's capability to see patients is essential to determine appropriate staffing ratios so that residents can have adequate opportunities in which to build their clinical skills and provide the safest and most efficient care possible to patients.

Our previous work has demonstrated that EM residents make steady gains in productivity over the course of their first (intern) year,[2] while the gains seen between subsequent years of residency are smaller and not evenly distributed over time, which has been well-established in prior studies of resident productivity.[3-7] It remains unclear whether the steady increase in productivity over intern year is a general effect of training as a physician, or specific to experience in the ED. While there are substantial differences in the content and structure of EM training programs relative to those in other fields such as internal medicine or obstetrics, many of the tasks expected of interns, such as performing and communicating a reliable history and physical, are core clinical skills common to many specialties, which trainees may generally perform with greater efficiency and confidence over time, regardless of the specific clinical setting in which they are practicing. Similarly, many non-clinical skills that might affect a physician's efficiency, such as the ability to navigate a hospital's electronic health record and computerized order-entry system, may generally improve when working across different areas of a hospital.

We sought to determine whether EM residents' gains in productivity over the course of their intern year correlated with the aggregate time they had spent in the ED, with the amount of time that had progressed in the academic year, or if there was a more complex relationship between the two. As off-service (non-EM) residents spend a much smaller amount of time in the ED, but an equivalent amount of time in overall training, we sought to evaluate their productivity in a secondary analysis. If gains in productivity are largely determined by a resident's overall clinical experience, off-service residents should demonstrate similar gains in productivity to EM interns over the course of the academic year.

Population Health Research Capsule

What do we already know about this issue?
Productivity, as measured by the number of patients a resident sees over the course of an emergency department shift, tends to improve over the course of training.

What was the research question?
Are improvements in productivity a result of time training in the ED, or on other rotations?

What was the major finding of the study?
Improvements in resident productivity in the ED are only associated with training there.

How does this improve population health?
Understanding rotation schedules' effect on resident productivity can make schedules more equitable and ensure timely care for patients throughout the academic year.

METHODS

This was a retrospective cohort study, conducted in an urban academic hospital ED with a three-year EM training program and approximately 55,000 visits per year. In our ED, interns assign themselves to new patients ad libitum. We evaluated consecutive resident shifts for the total number of new patients seen. Resident shifts at our institution are typically nine hours in length, with the last hour primarily to facilitate physician signout. At the beginning of the study period, a portion of interns also participated in longer, 11-hour shifts, which were constrained to a low-acuity area of the ED. These shifts were conducted in an area of the ED with substantially lower nurse and tech staffing, which severely limited residents' productivity; thus, we did no include these shifts in the final analysis. Off-service interns include those in internal medicine, obstetrics, neurology, anesthesia, and surgery transition years. EM interns at our program rotate in our hospital's ED for 22 weeks, while off-service interns generally rotate for two weeks, with some surgical and obstetrics interns rotating for three.

We abstracted resident productivity data from a central database of patient assignment timestamps from July 1, 2010, to July 1, 2016. Patient identifiers were not included, and specific patient timestamps (a form of protected health information) were abstracted into aggregate physician-shift data to meet HIPAA Safe Harbor criteria.[8] We anonymized

individual residents' identities. Physician-shifts were verified with a set of algorithms that examined for logical outliers (e.g., assignments to off-shift residents). We tracked changes in the physician assigned to a patient by our ED dashboard system, which corrects for multiple residents attempting to sign up for the same patient simultaneously or in succession, ensuring that the resident who performs the ultimate evaluation of the patient is the resident of record. The study was exempted by our institution's review board.

We measured our primary outcome measure of resident productivity in terms of the total number of new (non-signout) patients a resident saw per shift, recorded by the timestamps of when the resident signed up as the resident of record for a patient on our ED information system. Both the number of patients seen and relative value units (RVUs) have been used as measures of productivity in prior studies of resident and attending productivity in EM, reported alternatively as a total over a shift or as an hourly average. Each measure has relative strengths and weaknesses – patients seen directly reflects patient volumes but does not reflect patient complexity, whereas RVUs can reflect patient complexity and the time and effort involved in procedures, but can vary substantially with a physician's documentation and its interpretation by the individual coding it. Our study examines the total number of patients seen rather than RVUs due to the fact that the RVUs tied to a number of common ED procedures (such as laceration repairs) changed substantially between years of the study period.[9]

We performed statistical analysis with Python 3.5, using the SciPy ecosystem of packages for scientific computing and statistical analysis.[10-13]

We assessed our primary outcome measure, the total number of patients seen per resident shift, via a multivariate Gaussian regression using a generalized estimating equation (GEE). While sharing many features of traditional multivariate regression, GEEs are particularly well suited to datasets in which multiple longitudinal measurements are taken of the same subject, which in our case were groups of consecutive shifts by the same resident physician. In particular, GEEs give robust estimations of population-wide effects, even if the time-dependence between repeated observations is unknown or incorrectly specified.[14] We conservatively defined the covariance matrix for the model as exchangeable. The variables, based on their clinical and educational significance, were the week of the academic year and the number of weeks spent in the ED. As these variables are related, we also included their interaction term as an explicit variable. The interaction term reflects whether there is a change in the association with the number of weeks a resident has spent in the ED over the course of the year (i.e., whether a week in the ED in October is the same as a week in the ED in April, after a resident has completed many more off-service rotations). A two-tailed p-value < 0.05 was considered statistically significant.

RESULTS

We evaluated 7,779 first-year EM resident shifts from 7/1/2010 to 7/1/2016. Characteristics of the shifts are detailed in Table 1. First-year EM residents (Table 2) saw 7.16 (95% confidence interval [CI] [6.87 – 7.45]) patients per shift at the beginning of their training, with an increase of 0.20 (95% CI 0.17 – 0.24]) patients per shift with each week in the ED, leading to 11.5 (95% CI [10.6 – 12.7]) patients per shift at the end of their 22 weeks of training in the ED. The week of the academic year was not associated with any improvement in productivity, and the interaction between weeks in the ED and the week of the academic year was not significant.

Our secondary analysis evaluated 2,328 shifts of off-service interns working in the ED (Table 3). These interns saw on average 5.43 (95% CI [5.02 – 5.84]) patients per shift when starting in the ED, with 0.46 (95% CI [0.25 – 0.68]) additional patients per shift for each successive week of training in the ED, leading to a total of 6.35 (95% CI [5.52 – 7.82]) at the end of a typical rotation. The week of the academic year again was not significant, nor was the interaction with weeks in the ED.

DISCUSSION

The development of EM resident productivity over the course of training has been examined by a number of studies, which have consistently found that the greatest increases in productivity occur during intern year, regardless of the measure used to evaluate productivity (such as patients per hour or RVUs).[2-7,15] When viewed in terms of patients per hour (the most common resident productivity metric in the literature) our findings of 0.90 (95% CI [0.86 – 0.93]) patients per hour at the beginning of the year are similar to those seen for EM interns in prior studies, which have ranged from as low as 0.73 (95% CI [0.62 – 0.94])[3] to as high as 1.11 (95% CI [1.02 – 1.20]).[16]

The transition from slow, steady improvements across intern year, to much less consistent improvements across more senior years of residency seen in prior studies may reflect the fact that novices within a field can make relatively rapid gains as they progress from the step-by-step performance of fundamental tasks, to performing them relatively automatically.[17] The gains made by more experienced trainees in terms of efficiency are smaller, and potentially focused elsewhere, such as in managing more difficult cases, or providing support and teaching to more junior colleagues.

Progression of resident clinical responsibilities may provide another potential explanation for the diminishing productivity gains after intern year seen in prior studies. Within our institution's EM residency program, patients with unstable vital signs are preferentially assigned to more senior residents immediately after they arrive at triage.[18] The addition of many more acute patients to senior residents' workloads, who are more likely to require procedures, consultations, and re-evaluations, increases the complexity residents face with each patient workup. Similarly, the irregular intervals between

Table 1. Characteristics of residents and shifts evaluated.

Characteristic	N (%)
Residents	441
Emergency Medicine (22 weeks in ED)	77 (17.5%)
Off-Service	364 (82.5%)
Medicine (2 weeks in ED)	286 (78.6%)
Obstetrics (3 weeks in ED)	27 (7.4%)
Podiatry (3-4 weeks in ED)	10 (2.7%)
Transitional Medicine (3 weeks in ED)	28 (7.7%)
Transitional Surgery (3-4 weeks in ED)	13 (3.6%)

ED, emergency department.

Table 2. Total number of patients seen per shift for emergency medicine interns: generalized estimating equation model.

Characteristic	Coefficient	Standard error	P value	95% CI
Intercept	7.16	0.15	<0.001	6.87 – 7.45
Weeks in ED	0.20	0.02	<0.001	0.17 – 0.24
Weeks of the academic year	0.01	0.01	0.130	0.00 – 0.02
Weeks in ED* Weeks of the academic year (interaction)	0.00	<0.00	0.904	0.00 – 0.01

The model estimates the per-shift productivity of an average emergency medicine (EM) intern as a function of the number of weeks spent in the emergency department (ED), the weeks of the academic year, and their interaction. For instance, an EM intern who has spent four weeks in the ED would see 7.16 + 4 * (0.20) = 7.86 patients per shift (95% CI [confidence interval] 7.55 – 8.41), without a significant difference between an intern who has just started the year (at academic week 4) or one who has had several off-service rotations (e.g., at academic week 12).

Table 3. Total number of patients seen per shift for off-service interns: generalized estimating equation model.

Characteristic	Coefficient	Standard error	P value	95% CI
Intercept	5.43	0.21	<0.001	5.02 – 5.84
Weeks in ED	0.46	0.11	<0.001	0.25 – 0.68
Weeks of the academic year	0.01	0.01	0.235	0.00 – 0.02
Weeks in ED* Weeks of the academic year (interaction)	0.00	<0.00	0.017	-0.02 – 0.00

The model estimates the per-shift productivity of an average off-service intern in the emergency department (ED) as a function of the number of weeks spent in the ED, the weeks of the academic year, and their interaction. For instance, an internal medicine intern who has spent two weeks in the ED would see 5.43 + 2 * (0.46) = 6.35 patients per shift (95% CI [confidence interval] 5.52 – 7.20) without a significant difference when in the academic year the rotation occurred.

when these patients arrive increases the number of potential interruptions that residents face, and may complicate strategies that allow interns to increase their productivity, such as trying to see several patients in close geographic proximity to one another. In light of these constraints, it would be difficult for residents starting their second year to continue making linear gains in productivity.

The substantial difference in initial productivity between EM residents and off-service residents may reflect the fact that even basic tasks, such as conducting a history and physical, may vary substantially between EM and other fields. The EM milestones specifically delineate that a more advanced history and physical examination is a focused one.[1] In comparison, the history and physical typically practiced by an internal medicine resident for an admission may be much more comprehensive than is needed in an ED evaluation.

While many specialties require trainees to carry out focused evaluations in certain situations, such as in closely-scheduled clinic appointments, these evaluations may be structured differently than those conducted during ED

evaluations. For instance, the types of problems an internal medicine resident typically sees when caring for patients in clinic may center more on preventative care or management of existing conditions, with fewer evaluations of undifferentiated acute complaints, such as chest pain. Similarly, the evaluations performed in clinic are generally sequential, rather than concurrent, as is often required for managing ED patients, which likely require different skills and heuristics.[6,9,20]

One potential explanation for EM residents' initial advantage in productivity is simply that they have had previous experience with EM by virtue of their medical student rotations. Medical students who successfully match in EM are often advised to have two rotations in EM prior to residency,[21-23] which typically entail 14 shifts each.[24] Accordingly, our model suggests that after a month of experience in the ED (typically 27-28 shifts), off-service residents will perform at an equivalent level to that at which their EM resident peers start.

Operationally, our study suggests that an EM intern who has his/her first ED shifts in November is functionally the equivalent of an EM intern starting in the ED in July. Program directors should plan accordingly to ensure that residents have balanced rotation schedules; otherwise, the program's ED will face substantial gaps in throughput later in the year. Similarly, the semi-annual nature of Clinical Competency Committee resident reviews may risk unfairly evaluating residents with late ED rotations relative to their peers. If resident schedules cannot be evenly distributed due to scheduling constraints, program directors may consider staggering resident reviews to evaluate their residents at a point when they have had equivalent amounts of time in the ED. EM faculty should be made aware of the potential experience gap when evaluating interns at different times during the academic year.

While our findings show a strong correlation between time spent in the ED and interns' productivity, and do not show evidence of a ceiling effect to the association at 22 weeks, this does not suggest that residents need additional time in the ED during their intern year. Rotations outside of the ED fulfill important roles within EM training, which aren't necessarily reflected in terms of productivity. Although two interns who both have spent two months in the ED may demonstrate similar productivity, if one of them has already had rotations in intensive care and anesthesia, his comfort in dealing with critically ill patients and performing procedures may be very different.

LIMITATIONS

Our study was conducted at a single academic ED at an urban tertiary care center. The ad libitum structure of intern patient assignments at our site may not reflect productivity at programs in which residents are assigned patients by a supervising physician or on a rotational basis, and may therefore underestimate resident physicians' capacity based on their willingness to see additional patients. Our model does not specifically address the burdens of patient signout or the quantity of patient arrivals per shift; however, intern schedules are designed to maximize the fairness of shift distributions; thus, interns' shifts will reflect a relatively balanced distribution of busy shifts. Our model also does not address the potential effects of shift length on productivity, as longer shifts have been associated with diminishing productivity.[25]

Given the substantial association between experience in the ED and productivity demonstrated in our study, our model does not take into account the volume of time spent in EM rotations prior to starting residency, which may affect a resident's baseline productivity. Finally, as all of our EM interns rotate in our ED for 22 weeks, we cannot assess whether there is a potential ceiling effect for additional weeks of ED training, apart from that imposed by graduating to the second-year role. We welcome further research on this topic from programs where interns have more time within their primary ED setting to see if the effect continues.

CONCLUSION

EM interns' productivity in the ED correlates with the they have spent training in the ED, and does not appear to be affected by time spent on off-service rotations. Accordingly, their productivity should be evaluated relative to the aggregate time they have in the ED, rather than the time in the academic year. While we believe that productivity is an important measure of a resident's clinical progression, we encourage further research to help establish measurable outcomes of the other milestones, and to identify strategies that can help residents improve their productivity throughout training.

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Emergency Medicine Student End-of-Rotation Examinations: Where Are We Now?

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BACKGROUND

Assessment of medical students following the completion of clerkships often involves administration of an examination.[1,2] Before 2011 there was no nationally available, standardized examination for students completing emergency medicine (EM) rotations, and EM clerkship directors (CDs) likely used examinations developed within their own institutions. Significant progress has been made and there are currently several options available to CDs for assessment of students completing EM rotations, including the National EM M4 examinations, Version 1 (V1) and Version 2 (V2), and the National Board of Medical Examiners (NBME®) EM Advanced Clinical Examination (ACE).

OBJECTIVES

This review is a descriptive summary of the development of these examinations and their relevant usage and performance data. In particular, we describe how examination content was edited to affect desired changes in examination performance data and offer a model for educators seeking to develop their own examinations.

CURRICULAR DESIGN

In 2011 the Clerkship Directors in Emergency Medicine (CDEM) developed the first nationally available, standardized examination to assess fourth-year medical students (M4) completing an EM rotation.[3] This examination, the National EM M4 examination, consists of 50 multiple-choice questions written according to the NBME® item-writing guidelines[4] and assesses topics in a published EM M4 curriculum.[5,6] A second comparable version of this examination was released in 2012.[7] Both versions were expanded to 55 questions in 2015 and are updated annually by CDEM.

National EM M4 examination performance is reviewed annually including student scores, item difficulty (p-value), the percent of students answering a question correctly, and item discrimination. Examination developers aimed for a broad range of difficulty of questions, reflected by a broad range in scores, with a target mean examination score of 80% correct. The mean score of V1 of the National EM M4 examination has ranged from 76.5-81.9 with standard deviation (SD) 3.6-4.6, from its implementation in 2011 through 2017. The fluctuation in examination means is attributed in large part to annual edits to the examination. For example, in 2015 six questions with p-values > 0.95 were revised to generate more difficult questions, and the mean score dropped appropriately from 81.5 (SD 3.7) to 78.2 (SD 4.2).[8] The mean score of V2 was 72.1 (SD 4.0) in 2012, the first year it was available. Four of the 50 questions had p-values < 0.3 and were revised.[9] Subsequently, from 2013-2017 the mean examination score ranged from 77.3-82.1 (SD 3.8-4.9).

The point biserial correlation (r_{pb}) is a measure of item discrimination and reflects how well a question distinguishes a student who performed well on the examination from those who did not. The r_{pb} ranges from -1 to 1 with positive values indicating a positive correlation and values > 0.2 considered reasonably good.[10,11] The average r_{pb} for V1 questions ranged from 0.201-0.217 from 2011-2017. The average r_{pb} for V2 questions was 0.196 in 2012, the first year it was available, and improved to 0.234 the following year after nine questions with $r_{pb} < 0.2$ were revised to improve performance.[9] The range of r_{pb} for V2 questions since revisions in 2013 until 2017 has been 0.234-0.258.

These examples of examination modification demonstrate the ability to edit underperforming items to more closely align with desired examination performance metrics. Educators seeking to develop examinations could employ similar techniques.

IMPACT

The table shows the number of examination administrations and the number of clerkships using the examinations. In 2016-2017, 72 clerkships from 69 U.S. medical schools used V1, and 48 clerkships from 43 U.S. medical schools used V2.

The NBME® provides examinations to assess students completing clerkships in many disciplines. In 2013, NBME® released its first examination for assessment of EM students. The NBME® EM ACE was developed by a taskforce of CDEM members and NBME® staff to assess content in the same published curriculum assessed by the National EM M4 examinations. The EM ACE consists of 100 multiple-choice items. Scores are equated across forms and are scaled to have a mean score of 70 and SD of 8. Of the 145 U.S. medical schools accredited by the Liaison Committee on Medical Education (LCME), 56 (39%) used the EM ACE in 2016-2017.

In 2015, the NBME® conducted a webcast, standard-setting study to develop grading guidelines for the EM ACE. The recommended range for minimum passing score was 53-62 and for honors score was 74-91.[12] Of note, the NBME® charges a per-examination fee for use of the EM ACE, whereas the National EM M4 examinations are freely available to CDs from LCME-accredited medical schools.

In summary, in the past six years, several end-of-rotation examination options for EM M4s have become available and are being widely used. The National EM M3 examination, also developed by CDEM, was scheduled for release July 1, 2017 (M. Tews, personal communication). These examinations help fill a void in assessment of EM students.

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Table. Usage of the National EM M4 examinations (Version 1 and Version 2) and the NBME® EM ACE since implementation.

	Number of examination administrations			Number of clerkships administering examination		
Academic year	V1	V2	ACE	V1	V2	ACE
2011-12	1,828	n/a^	n/a	20	n/a	n/a
2012-13	3,229	576	n/a	48	48	n/a
2013-14	2,718	534	3,844	46	42	50
2014-15	2,216	606	4,721	47	52	45
2015-16	2,745	955	5,260	66	48	57
2016-17	2,847	1,128	5,231	72	48	60
Total	15,583	3,799	19,056			

ACE, Advanced Clinical Examination.
* Indicates the academic year from July 1 through the following June 30 for all years except 2016-17, which is through June 1.
^ "n/a" indicates the examination was not available for those dates.

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Implementing a Team-Based Fourth-Year Medical Student Rotation in Emergency Medicine

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[West J Emerg Med. 2018;19(1)137–138.]

BACKGROUND

Historically, fourth-year (M4) medical students at the Medical College of Wisconsin who were interested in emergency medicine (EM) worked with faculty in the emergency department primarily in a see-one-staff-one clinical model. Students were sent to see a patient, obtain a history and perform a physical examination and then present a summary to the faculty.[1,2,3] The faculty evaluations of these student interactions constituted the majority of the student's clinical score and clerkship grade.[4] However, in the busy clinical environment of a Level I trauma center, it was challenging for faculty to dedicate one-on-one time with students. As a result, students frequently waited on busy faculty to assign them a new patient rather than proactively gaining clinical experience. Therefore, a new team-based clinical model was created after obtaining input from faculty, residents and students to increase student interactions with patients. Although similar models might exist at other programs, there was limited evidence to guide a student's team function in the ED.[5,6] As a result, it was decided to study the impact of the change on student evaluations and case logs, as well as faculty and student perceptions, all of which stood to be impacted the most by the change.

OBJECTIVES

The objectives for this educational innovation were to 1) implement a team-based model of a M4 student clinical experience; 2) measure the student's clinical performance from their end-of-shift evaluations and case logs; and 3) assess the perception of the model from faculty and students.

CURRICULAR DESIGN

We obtained a prospective collection of data from 32 M4 students over a four-month time period from July to October 2015. Students were randomly assigned to a geographic team that used either the team-based model or traditional staffing model. Faculty and residents received instructions on expectations in the months prior to implementation via emails, group presentations and face-to-face meetings, while students were informed at each month's orientation. Students in the traditional model were assigned to faculty without a change in expectations compared to previous years. In the team-based model, students continued to work one-on-one with faculty when convenient, but they were also expected to proactively contribute to the care of any patient on their team or when asked by the faculty or resident.

Table. Student level of involvement in EM clerkship, comparing team-based vs. traditional clinical involvement.

	Team-based		Traditional	
Level of Involvement	Number of patients	Percent of total patients	Number of patients	Percent of total patients
Primarily saw patient with faculty only	589	32.5%	686	63.1%
Saw patient in team-based model; followed majority of time	583	32.2%	110	10.1%
Saw patient in team-based model, with minor involvement	459	25.3%	99	9.1%
Shadow faculty member only	182	10.0%	192	17.7%
Total	1911	100.0%	1135	100.0%

Examples of student contributions included helping with procedures, calling the poison center, gathering history from nursing homes and interacting with consultants for any team patient. Faculty completed end-of-shift evaluations in both models; faculty and students completed a survey regarding their experiences. We analyzed student case logs to determine their level of involvement with faculty (Table). Narrative comments were analyzed to understand faculty and student perceptions. We conducted analysis by IBM® SPSS® v21.0. The study was deemed exempt by the Medical College of Wisconsin Institutional Review Board.

IMPACT / EFFECTIVENESS

Our preliminary work suggested that the team-based model provided students more involvement in patient care without negatively impacting their clinical evaluations. Of the 339 end-of-shift evaluations completed by faculty, there were no statistically significant differences in how faculty assessed students between the two models; however, the team-based model reported a trend towards higher mean scores. Students saw significantly more patients in the team-based model (p=.000) with 58% of patients seen as part of the team, while students in the traditional model saw 60% of patients one-on-one with faculty (Table). This demonstrated that the increase in patient involvement for the team-based model occurred when students participated as part of the team.

In reviewing the faculty and students' perceptions, we found that many students saw the value in this model, commenting that "my skills and knowledge could be utilized and [I could] function as a valuable member of the team" and that it "allowed me to see more patients, be helpful to the team, learn more and prepare to handle multiple patients." Some students preferred the traditional model because it allowed "time for informed decision-making," and it "felt like we were pulled in less directions." Faculty viewed this as an opportunity to help differentiate students, commenting that the model "pushes students to be proactive and helps separate out students a bit more who took initiative versus who didn't." Students highly rated their interactions with faculty and the faculty's excellence in teaching in both models.

Limitations of this study include that the case logs were self-reported by students and that faculty evaluations of students are subjective measures of student performance, despite use of a standardized form. Additionally, in retrospect we found that while the deliberate rollout of the model helped socialize the idea, more time could have been spent post-implementation verifying that the model was understood and adopted correctly by faculty, residents and students. This would have likely facilitated a quicker transition, although the model successfully became part of the department's educational culture.

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Development of a Case-based Reading Curriculum and Its Effect on Resident Reading

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Textbook reading plays a foundational role in a resident's knowledge base. Many residency programs place residents on identical reading schedules, regardless of the clinical work or rotation the resident is doing. We sought to develop a reading curriculum that takes into account the clinical work a resident is doing so their reading curriculum corresponds with their clinical work. Preliminary data suggests an increased amount of resident reading and an increased interest in reading as a result of this change to their reading curriculum. [West J Emerg Med. 2018;19(1)139-141.]

BACKGROUND

Textbook reading plays a key role in the foundational knowledge base for many residents and is often incorporated into residency programs' core curriculum. Many residency programs place residents on a reading schedule that is applied to all residents simultaneously without regard to what rotation the resident is currently on. This may force the resident to choose between completing their assigned reading versus reading about the patients they are caring for clinically.

OBJECTIVES

Our objective in developing this curriculum was to increase interest in and compliance with reading. The goal is that with increased interest and compliance, learning will occur, as it has been shown that regular reading assignments increase in-training examination scores.[1,2] Although residency programs may provide their residents with structured reading schedules, we could not identify any that correlate the reading schedule with what the resident is doing clinically. The learning theory guiding the creation of this reading curriculum is that of experiential learning: learning that is constructed from real-life experience.[3] We felt that if the learner could connect their clinical work with the textbook reading, experiential learning would occur and the learner would be actively involved in the learning process. We sought to identify whether making this correlation resulted in residents reading more and whether they were more interested in reading.

CURRICULAR DESIGN

We hold that there is a core body of knowledge, a core curriculum, that all interns should be expected to read. With this in mind, we reviewed the chapters offered in *Rosen's Emergency Medicine – Concepts and Clinical Practice* ("Rosen's") textbook and divided them into two categories: chapters to be read during the intern year of residency and chapters that should be read during the second and third years of residency. This division of chapters was initially determined by the author (AM) in her role as associate program director and agreed upon by the other two members of program leadership. Once the list of "intern chapters" was created, we assigned chapters to specific rotations that the interns were on. For example, chapters pertaining to obstetrical or gynecological emergencies were assigned to the intern while she was on her obstetrics/gynecology rotation. Similarly, chapters that were pertinent to other off-service rotations were assigned during these respective rotations. All chapters left over were to be assigned to the resident while working clinically in the emergency department (ED). A similar process was undertaken for the second- and third-year chapters, with pertinent chapters assigned during off-service rotations and the rest assigned while working clinically in the ED. Residents were provided with a complete list of the chapters and their length, in pages, prior to the intervention so that they were aware that chapters had considerable variability in their length.

For those chapters designated to be assigned while working clinically in the ED, an Excel spreadsheet was created, accessible to the individual resident and all attending physicians. At the end of a shift, the attending physician would peruse this list with the resident and assign a chapter, pertinent to the clinical cases seen that day. All interns and residents played an integral role in the decision of what chapter was to be assigned, and generally attendings deferred to the residents' decision of what chapter they would like to read. In the case that an attending forgot to assign a chapter, the resident could "self-assign" a chapter based on gaps in clinical knowledge that she perceived during that shift. Once the resident completed the reading assignment, he would go onto his spreadsheet and mark the chapter as "read" so that the same chapter would not be assigned more than once. Program leadership monitored the compliance and progress of the resident.

We used Google documents to store this information. Each resident had access to his own page; however, attending physicians had access to every resident's page.

IMPACT/EFFECTIVENESS

We surveyed residents prior to the implementation of the new curriculum and again three months after the initiation of the new curriculum. We obtained approval to disseminate this survey from our institutional review board. Residents were informed that the survey would be given two weeks before the surveys were administered so residents could keep track of their reading habits. The survey asked residents objective questions, such as how many hours per week they spent reading the Rosen's textbook, as well as subjective questions, such as how beneficial they felt the reading was to their overall education. (See Appendix for a complete list of survey questions.)

We found statistically significant improvement via t-test in all parameters studied with the implementation of the new curriculum (Figure). These parameters included average number of hours per week spent reading the Rosen's textbook (increased from 1.5 to 3.8, $p = 0.002$); how beneficial the Rosen's reading was to their overall education (scale of 0-10 where 0 meant that reading was not beneficial at all and 10

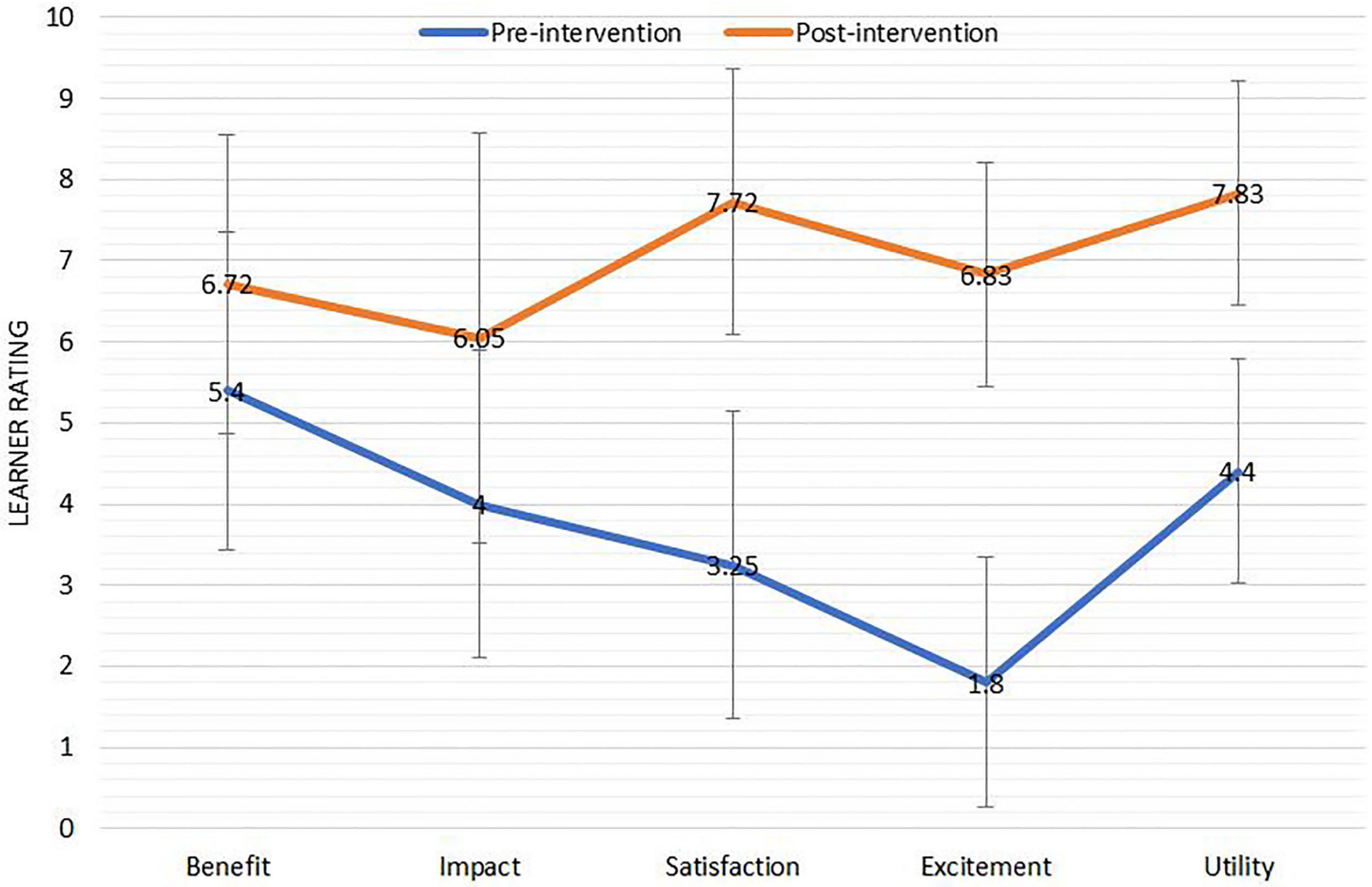

Figure. Learner ratings of the reading curriculum before and after the intervention. Average values are reported with error bars representing one standard deviation above and below the mean.

that reading was extremely beneficial; increased from 5.4 to 6.7, p = 0.03); the impact their Rosen's reading had on their clinical practice (scale of 0-10 where 0 meant that the reading made no impact on clinical practice and 10 means that reading has been extremely impactful on clinical practice, increased from 4.0 to 6.1, p = 0.007); and satisfaction with their current curriculum (scale of 0-10 where 0 meant the resident was completely unsatisfied with the curriculum and 10 means the resident was extremely satisfied with the curriculum, increased from 3.3 to 7.7, p = 0.0005).

LIMITATIONS

Although all residents in this study used their Excel spreadsheet to track their reading, it would also be useful to measure to what degree the resident used the spreadsheet and how accurately it reflected the amount of reading actually completed, as residents may not have accurately recalled how much reading they actually did or may have provided false answers to please program leadership. Additionally, the study has inherent issues with generalizability as it was performed at a single institution that uses the *Rosen's Emergency Medicine* textbook as its main reading source. Additionally, the residents were not sub-analyzed based on their post-graduate year and this may have provided useful data.

CONCLUSION

Assigning textbook chapters that correlate with each resident's clinical rotation is an educational innovation that could easily be adopted at any institution; it requires no funding or purchasing of any special software or textbooks. After our program adopted this innovation, we experienced an increased interest in reading and a renewed sense of responsibility among the residents regarding their education. Further studies would explore whether there is a subsequent increase in in-training examination scores or first-time board passage rates, and investigate *why* the residents experienced such significant increases in the parameters studied.

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Free Open Access Medical Education (FOAM) Resources in a Team-Based Learning Educational Series

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Although Free Open Access Medical Education (FOAM) has become popular within emergency medicine, concerns exist regarding its role in resident education. We sought to develop an educational intervention whereby residents could review FOAM resources while maintaining faculty oversight. We created a novel curriculum pairing FOAM from the Academic Life in Emergence Medicine (ALiEM) Approved Instructional Resources (Air) series with a team-based learning (TBL) format. Residents have an opportunity to engage with FOAM in a structured setting with faculty input on possible practice changes. This series has been well-received by residents and appears to have increased engagement with core content material. Qualitative feedback from residents on this series has been positive and we believe this is the first described use of TBL in emergency medicine. [West J Emerg Med. 2018;19(1)142–144.]

BACKGROUND

Free Open Access Medical Education (FOAM) has rapidly expanded within emergency medicine (EM). Since 2013, 183 blogs and podcasts have focused on EM; however, a 2016 review identified content corresponding to only 71.5% of the required core content in EM as defined by the American Board of Emergency Medicine's *Model of the Clinical Practice of Emergency Medicine*.[1] In advocating FOAM in resident education, Nickson argues that physicians must develop the ability to evaluate the relevance of specific content and suggests that a flipped-classroom model "guards against FOAM resources being misunderstood by learners if they do not have sufficient base knowledge or clinical experience to appreciate the nuances."[2]

We hypothesized that pairing FOAM with a team-based learning (TBL) approach would allow us to integrate these resources while maintaining faculty oversight and improving engagement. The TBL technique has been used widely in medical education. A systematic review in June 2016 identified 118 references to TBL in health professions education; however, 47% included medical students and only 6% related to residents.[3] Poeppelman completed a review of the use of TBL in graduate medical education in 2016 and found no reported use within EM training.[4]

OBJECTIVES

We sought to develop a structured educational intervention whereby residents could review curated FOAM that covered core content and innovation and integrate this knowledge with a TBL session. The intervention was designed to be easily integrated into our current didactic schedule with no need for additional faculty resources.

CURRICULAR DESIGN

We created this series by pairing Academic Life in Emergence Medicine (ALiEM) Approved Instructional Resources (Air) series content to a TBL session. ALiEM Air has been used by 125 EM residencies and over 1,200 residents as of June 2017.[5] While FOAM can be subject to concerns regarding quality, ALiEM was selected because of its clearly defined peer-review process.[6] Two to four FOAM resources are selected to highlight 1-2 specific topics within a content module. We anticipate that residents will spend one hour in advanced preparation. A 50-minute TBL session includes both an individual and team quiz.[7] The quiz is a combination of the ALiEMU quiz and questions created by the faculty to highlight key points.

During the team component, each question is discussed and each team's pooled answer is presented. Residents have an opportunity to discuss the content within the team as well as with

the larger group, sharing knowledge and experience. The faculty leads a guided discussion based on the responses. Cumulative team scoring for the year encourages adequate preparation. To date, sessions covering cardiology, trauma, EM procedures, and HEENT were created to coordinate with the content areas of the month during which they were scheduled. The figure provides a flow diagram for the asynchronous and classroom components of TBL.

IMPACT/EFFECTIVENESS

This didactic series using FOAM and TBL has been well received by residents and appears to have increased engagement with the content. The TBL format provides opportunities for senior residents to teach junior colleagues. Although formal efficacy evaluation has not been conducted, resident qualitative feedback has been positive. Feedback was solicited following each session using our conference feedback mechanism as well as annually during our program curriculum review. Following the first four sessions, residents provided 32 unique comments.

The following are representative comments: "good discussion, great to have reading structure outside of conference;" "very engaging;" "FOAM materials were high quality… I found myself reading beyond the assigned topics;" and "it's great working collaboratively with the upper level residents." Some residents found the repetitive nature of individual and team-based questions was not helpful and some found the overall classroom to be too loud. In response, we introduced a phone app to complete quizzing and the format was altered slightly to allow each team to present the teaching points from one resource after the individual quiz and team discussion. When polled following this change, nine of 17 respondents preferred the new format with team-based teaching.

We have demonstrated an educational innovation through the use of FOAM paired to a TBL approach that requires no additional classroom time or faculty resources. We anticipate that this format will enable residents to critically appraise FOAM

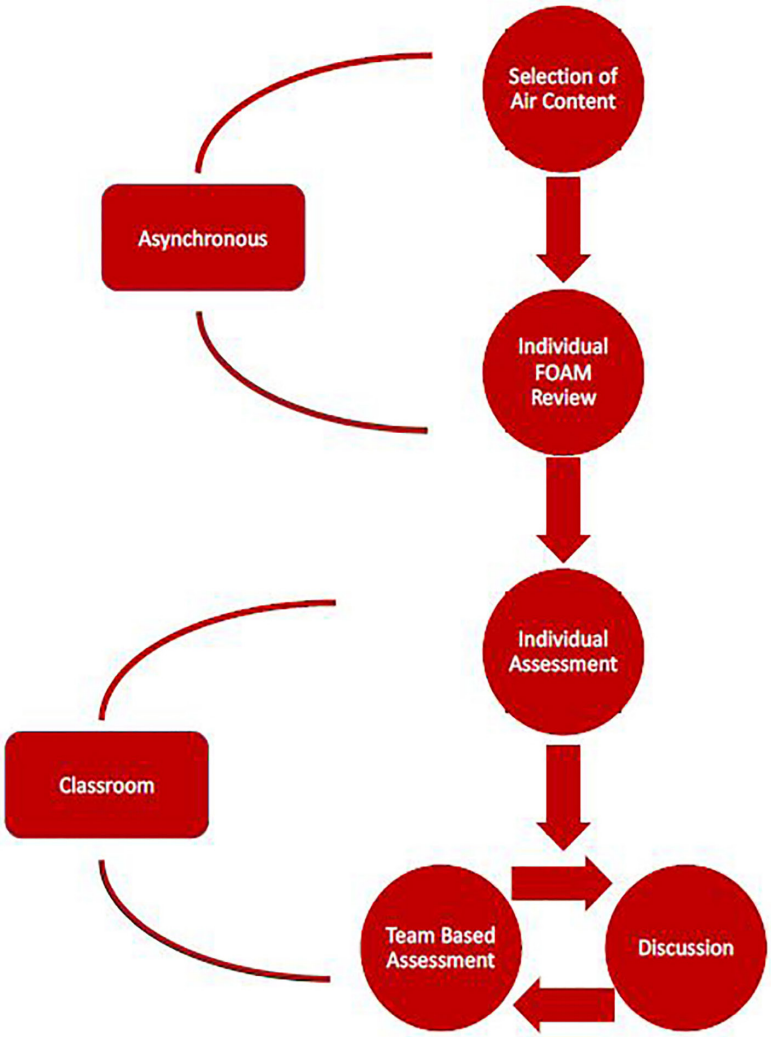

Figure. Curricular structure.
FOAM, Free Open Access Medical Education.

resources in a setting that allows for faculty input and oversight. This is the first report of the use of TBL within an EM residency of which we are aware. Future evaluation should focus on the educational effectiveness of this model and implementation in graduate medical education where this technique is relatively underrepresented in the literature.[3]

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Bringing the Flipped Classroom to Day 1: A Novel Didactic Curriculum for Emergency Medicine Intern Orientation

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Most emergency medicine (EM) residency programs provide an orientation program for their incoming interns, with the lecture being the most common education activity during this period. Our orientation program is designed to bridge the gap between undergraduate and graduate medical education by ensuring that all learners demonstrate competency on Level 1 Milestones, including medical knowledge (MK). To teach interns core medical knowledge in EM, we reformulated orientation using the flipped-classroom model by replacing lectures with small group, case-based discussions. Interns demonstrated improvement in medical knowledge through higher scores on a posttest. Evaluation survey results were also favorable for the flipped-classroom teaching format. [West J Emerg Med. 2018;19(1)145-147.]

BACKGROUND

Almost all emergency medicine (EM) residencies provide orientation programs for their incoming interns.[1] Orientation programs are commonly a mix of clinical time, didactic teaching, administrative onboarding, and social activities.[1] While medical educators have sought to replace lectures with alternative methods that promote active learning and longer term retention,[2-3] lectures continue to be the predominant educational activity during EM orientations.[1,4-5] Few programs have yet to engage in baseline, or programmatic, assessment of Level 1 Milestones for incoming interns.[1,6]

More recently, flipped-classroom methods have been adopted by EM residency programs.[7-8] The flipped- classroom method generally involves preparation by the learner, in the form of self-directed learning, in advance of a face-to-face classroom meeting. Class time is reserved for application of the learner's new knowledge through facilitated discussion of problems or cases.

OBJECTIVES

The purpose of our redesigned intern orientation program was to provide and assess intern's core medical knowledge (Level 1 Milestone-MK) to enable them to succeed in residency. In an attempt to improve the didactic component of intern orientation, we developed case-based, pre-reading assignments organized by common EM topics. Our approach mirrored the flipped-classroom model we employ throughout our entire residency program.

CURRICULAR DESIGN

The orientation program was six weeks in length, running from mid-June to the end of July. Core EM knowledge teaching was allocated to 21 hours of direct instruction (seven hours per week) during the last half of the program. Each hour of direct instruction time represented a topic defined by a "chief complaint." Hour- long lectures that had previously covered this core content were replaced by case-based, interactive small group sessions.

Small group sessions were designed by core faculty and senior EM residents, and reviewed by the orientation director. Residents were expected to prepare for each session by reading a patient case and covering the prescribed learning material. Residents were provided with guiding questions for each patient case. These included questions about differential diagnoses, management, and dispositions. Residents were also encouraged to find their own resources to answer guiding

questions. During the sessions, faculty members facilitated the discussion by navigating a facilitator guide that included the guiding questions. Examples of topics covered were chest pain, abdominal pain, shortness of breath, airway management, headache, and back pain, among others.

To measure knowledge gains, we contracted with TrueLearn® to generate two parallel examinations, each containing 100 randomly selected items from their SmartBank for Emergency Medicine.[9] One examination was administered in the first week of orientation, while the other was administered during the last week. The examinations were timed (power tests) and completed online. We also implemented a program evaluation survey that included a retrospective pretest (RPT) question about resident gains in proficiency on core content covered in small group sessions.[10] Our institutional review board declared this exempt research.

IMPACT / EFFECTIVENESS

Twelve of 16 residents completed both pre- and posttests. Knowledge test scores were reported by TrueLearn® as percentage correct. We analyzed these with a paired t-test and Cohen's d effect size. Interns made an average gain of 12.6 percentage points between pre- and posttests. This was considered statistically significant with an extremely large effect size ($t=-6.78$; $df=11$; $p\leq.001$; $es=-2.73$; see Figure).

In response to the retrospective pretest evaluation item, eight of 10 (80%) residents said that they felt more proficient with the core content covered in the small group sessions than they did before completing orientation.

Use of the flipped classroom during our orientation had the side benefit of preparing residents for the teaching methods employed throughout residency. While knowledge test results showed significant and large learning gains, we were not able to directly attribute these gains to the flipped-classroom approach. We did not assess resident preparation for, or participation in small group discussions. However most residents rated the small group sessions as beneficial.

Other evaluation results suggested the need for faculty development with facilitating small group discussions. We also learned the importance of posting learning material on an easy-to-access online learning management platform, particularly for residents who worked clinically at dispersed sites.

We observed some preliminary evidence that the flipped classroom model is an effective teaching method that provided learners with the ability to customize their study time. This is particularly helpful during orientation for interns who come from varied medical school backgrounds. We did not, however, make a direct comparison to a lecture-based

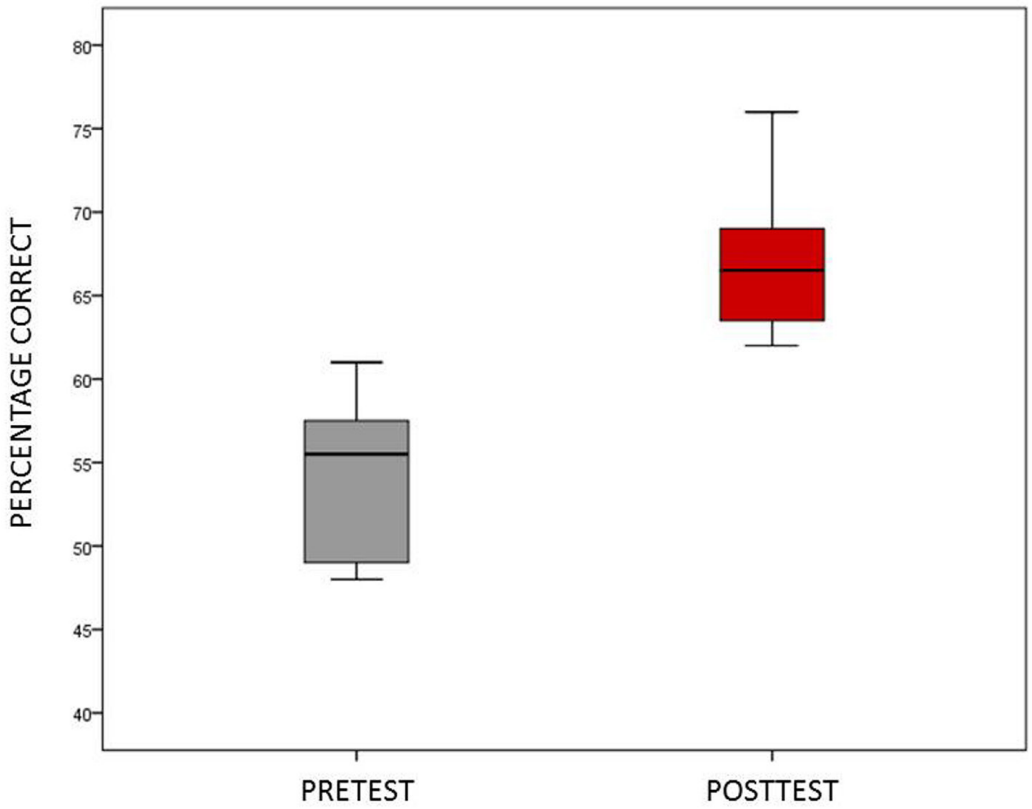

Figure. Box and whisker plot representing the median and distribution of 12 residents percentage scores on pre- and post knowledge tests generated from the TrueLearn® Smartbank.

orientation. Additional evidence is needed through controlled experiments comparing lecture to flipped-classroom methods.

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Using Medical Student Quality Improvement Projects to Promote Evidence-Based Care in the Emergency Department

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Introduction: The Association of American Medical Colleges' (AAMC) initiative for Core Entrustable Professional Activities for Entering Residency includes as an element of Entrustable Professional Activity 13 to "identify system failures and contribute to a culture of safety and improvement." We set out to determine the feasibility of using medical students' action learning projects (ALPs) to expedite implementation of evidence-based pathways for three common patient diagnoses in the emergency department (ED) setting (Atrial fibrillation, congestive heart failure, and pulmonary embolism).

Methods: These prospective quality improvement (QI) initiatives were performed over six months in three Northeastern PA hospitals. Emergency physician mentors were recruited to facilitate a QI experience for third-year medical students for each project. Six students were assigned to each mentor and given class time and network infrastructure support (information technology, consultant experts in lean management) to work on their projects. Students had access to background network data that revealed potential for improvement in disposition (home) for patients.

Results: Under the leadership of their mentors, students accomplished standard QI processes such as performing the background literature search and assessing key stakeholders' positions that were involved in the respective patient's care. Students effectively developed flow diagrams, computer aids for clinicians and educational programs, and participated in recruiting champions for the new practice standard. They met with other departmental clinicians to determine barriers to implementation and used this feedback to help set specific parameters to make clinicians more comfortable with the changes in practice that were recommended. All three clinical practice guidelines were initiated at consummation of the students' projects. After implementation, 86% (38/44) of queried ED providers felt comfortable with medical students being a part of future ED QI initiatives, and 84% (26/31) of the providers who recalled communicating with students on these projects felt they were effective.

Conclusion: Using this novel technique of aligning small groups of medical students with seasoned mentors, it is feasible for medical students to learn important aspects of QI implementation and allows for their engagement to more efficiently move evidence-based medicine from the literature to the bedside. [West J Emerg Med. 2018;19(1)148–157.]

BACKGROUND

Quality improvement (QI) initiatives to advance patient care have become widespread in healthcare.[1] The healthcare industry has adapted many "change" implementation tools from other industries, such as lean management, six sigma, and more recently bidirectional alignment.[1] Bidirectional alignment is the idea that an institutional problem should be evaluated and addressed from the bottom-up as well as the top-down.[2] This means giving the people on the frontline of care a voice in the ivory tower of organizational priority setting.[3] The Association of American Medical Colleges' (AAMC) initiative for Core Entrustable Professional Activities for Entering Residency includes as an element of Entrustable Professional Activity 13 to "identify system failures and contribute to a culture of safety and improvement."[4] The AAMC Aligning and Educating Quality Initiative has the aspiration of "aligning and educating for quality to assist medical schools in development of curriculum, faculty, and programs in systematic incorporation of these skills starting in the earliest stages of medical careers.[5]

We designed three educational innovations that stressed bidirectional alignment by pairing senior practitioners in the emergency department (ED) with teams of six third-year medical students on three separate QI initiatives designed to develop clinical pathways for congestive heart failure, pulmonary embolism, and atrial fibrillation. The rationale for such an approach is to pair the experience and knowledge of veteran practitioners with the learning mindset and fresh perspective of medical students to create novel solutions, thus improving quality of care.[6] Involving future-oriented learners in the processes of QI better enables organizations to proactively adapt to continually evolving regulations vs. reacting from the top-down with entrenched approaches to meeting standards of care.[7]

Population Health Research Capsule

What do we already know about this issue?
The AAMC Aligning and Educating Quality Initiative has the aspiration of encouraging the development of curriculum for quality improvement skills in the early stages of medical careers.

What was the research question?
Can third year medical students help expedite implementation of evidence-based pathways for common patient diagnoses in the emergency department (ED).

What was the major finding of the study?
Using bidirectional alignment of medical students with mentors, it is feasible for students to learn important aspects of QI.

How does this improve population health?
Using medical students to help promote evidence-based care in the ED indirectly improves population health.

OBJECTIVES

We set out to determine the feasibility of using third-year medical students' action learning projects (QI projects) to expedite implementation of evidence-based pathways for three common patient diagnoses in the ED setting as well as develop a model for promoting bidirectional alignment at an institutional level. We further evaluated clinician perspectives on using medical students at the forefront of QI pathway development.

CURRICULAR DESIGN

These prospective QI initiatives were performed over six months in three Northeastern PA hospitals. One was a Level I trauma center with an annual census of 90,000, one was a suburban hospital with an annual census of 60,000, and the third was an inner city hospital with an annual census of over 32,000 visits per year. Emergency physician mentors were recruited by medical school faculty to facilitate a QI experience for third-year medical students for each project. These physician sponsor/mentors had no training to lead such QI teams, but all were established leaders in the ED who were familiar with teaching (core emergency medicine [EM] residency faculty) and had participated in QI initiatives previously (examples: the ED vice-chair of QI, a hospital site director, etc). Students were given class time and network infrastructure support (including information technology and consultant experts in lean management) to develop, evaluate, and implement changes in clinical pathways. The timeline and detailed description of the program with faculty time estimates is provided in the table. The network institutional review board (IRB) reviewed the project and found it to be consistent with QI, and thus IRB oversight was not required.

Students had access to background network data that revealed potential for improvement in disposition (to home) for patients with all three diagnoses. Each group was expected to use lean management tools, such as plan-do-study-act, to develop a root-cause fishbone diagram to determine the current state, use A3 problem solving, determine and engage the key stakeholders, develop a clinical pathway, recruit champions for change management, and establish a plan for measuring the outcomes of their respective QI initiatives. Following conclusion of the initiatives the students were required to present their projects to peers and the key stakeholders.

The educational methods described were chosen to facilitate bidirectional engagement of senior providers and medical students in order to have a meaningful, team-based impact on QI initiatives in the ED.[8] This provided students with the opportunity to learn how clinical practices are evaluated and improved at an

institutional level, while enabling the many strata of providers at the clinical frontline to coordinate their efforts to improve quality of care. The students and providers noted challenges when it came to engaging in change management in a hectic and distracting work environment, reconciling multiple pathways from interdisciplinary feedback, and obtaining sufficient data from the electronic medical records. At the conclusion of the projects clinical providers were surveyed regarding their level of comfort with medical students being involved in future QI initiatives in the ED, as well as whether medical student involvement affected their likelihood of using the proposed clinical pathways.

IMPACT / EFFECTIVENESS

Under the leadership of their mentors, students accomplished standard QI processes such as performing the background literature search, assessing key stakeholders' positions with respect to patient care, and metrics for measuring success. Students effectively developed flow diagrams, computer aids for clinicians, educational programs and participated in recruiting champions for the new practice standard. They met with other departmental clinicians to determine barriers to implementation and used this feedback to help set specific parameters to make clinicians more comfortable with the changes in practice that were recommended. All three clinical practice guidelines (Figures 1-3) were initiated in an orchestrated manner at the consummation of the students' projects. These guidelines have been implemented for approximately six months.

After implementation, 86% (38/44) of the departmental providers felt comfortable with medical students being a part of future ED QI initiatives. Eighty-four percent (26/31) of the providers who recalled communicating with students on these projects (for example as a champion, as a clinician using the pathway, or having received education from the students) felt they were effective. The majority (66%) of providers surveyed felt that using medical students for developing these pathways did not affect their attitude on whether they would use the pathway in clinical practice. Only three providers surveyed felt that using medical students for developing these pathways would make it less likely they would use the pathway.

To date, this curriculum is limited by the fact that we do not have statistical outcome measures to report. However, since initiation, the network and ED QI committees following the implementation of these pathways have had no patient adverse or serious events to report. Additionally, the action learning project described is a curriculum portion of a program for medical students (USF SELECT). The SELECT program has faculty trained in lean methodology and leadership. These resources were available to our network without additional expense or training, although their faculty time is included in the model (Table 1). Whether this training is generalizable to other networks that may not have this robust availability of both medical student faculty or QI infrastructure is unclear.

Using this novel technique of bidirectional alignment of small groups of medical students with seasoned mentors, it is feasible for medical students to learn important aspects of QI implementation and allows for their engagement to more efficiently move evidence-based medicine from the literature to the bedside. Further study with data outcomes to illustrate consistency of algorithm use is needed.

Table 1. Timeline and training for action learning projects.

Task	Total hours	Faculty	Mentor /sponsor	Student	Start date	End date
Identify project sponsors/mentors	4	4	1	0	9/1/2016	10/5/2016
Team development (students receive class training) , projects are assigned and ALP starts	3	3	0	3	10/06/2016	10/06/2016
Project management (students receive class training, develop guiding principles, appoint a project leader and manager)	4	4	0	4	11/3 and 1/12/2017	1/12/2017
ALP Group class and/or workgroup time (students have class time to work on projects together) Meet with project sponsor, complete project structure, scope project, draft responsibility chart, develop A3	20	0	20	20	10/6/2016	4/27/2016
Prepare Project Report Out	2	0	0	2	4/27/2017	5/10/2017
Presentation skills (students receive class training)	1	1	0	1	4/27/2017	4/27/2017
ALP class presentations (students present to each other their projects)	4	4	2	4	5/11/2017	5/11/2017
Faculty evaluation of projects	3	3	0	0	5/11/2017	5/19/2017
Summary hours	41	19	23	34+	9/1/2016	5/19/2017

ALP, action learning project.

+ Exact estimate of time for students is not possible. Students had 34 hours of protected class time to complete this work, but the vast majority spent many more hours outside class researching their topics, connecting with champions, and doing departmental staff training.

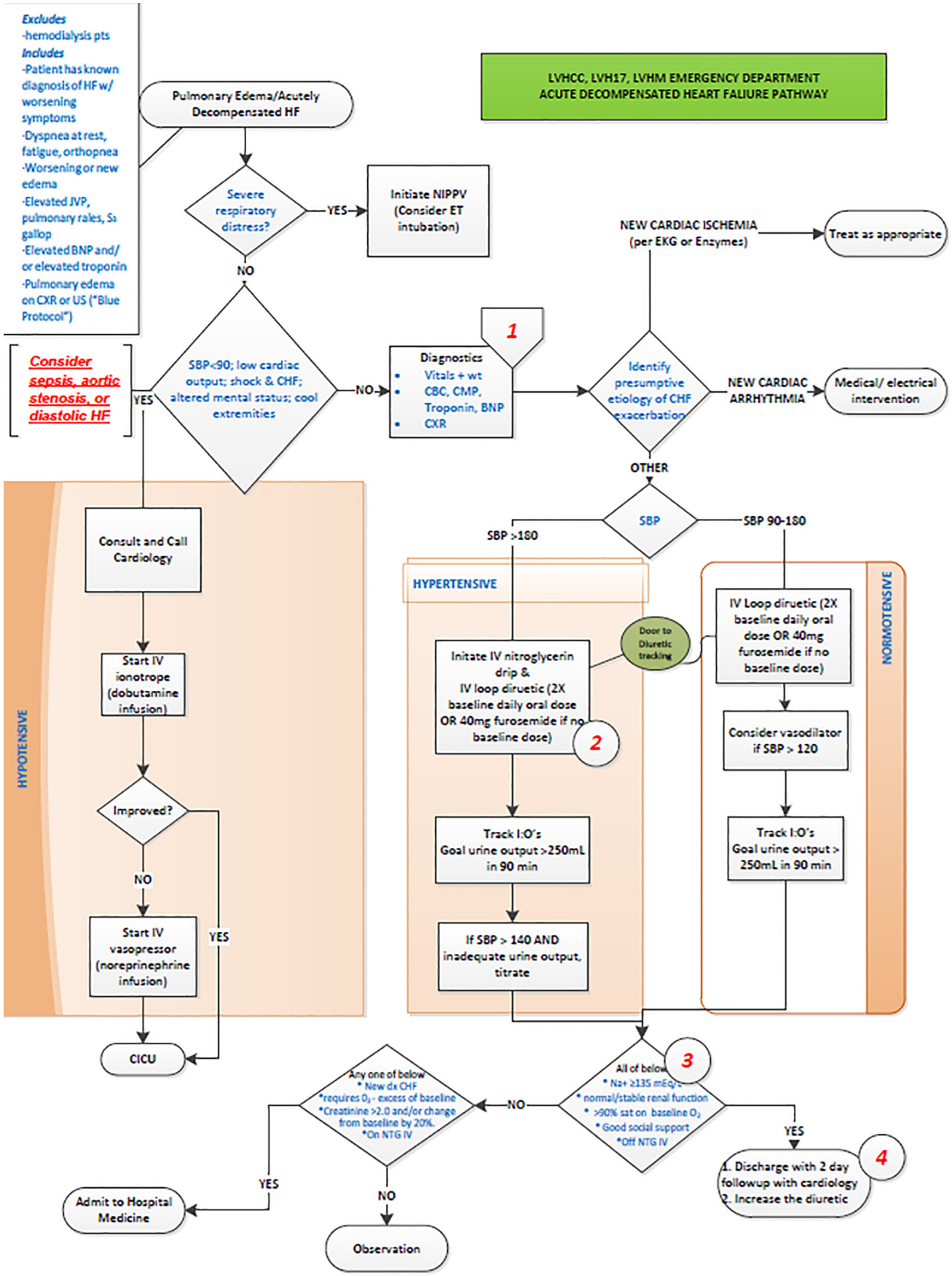


Figure 1. Congestive heart failure pathway.

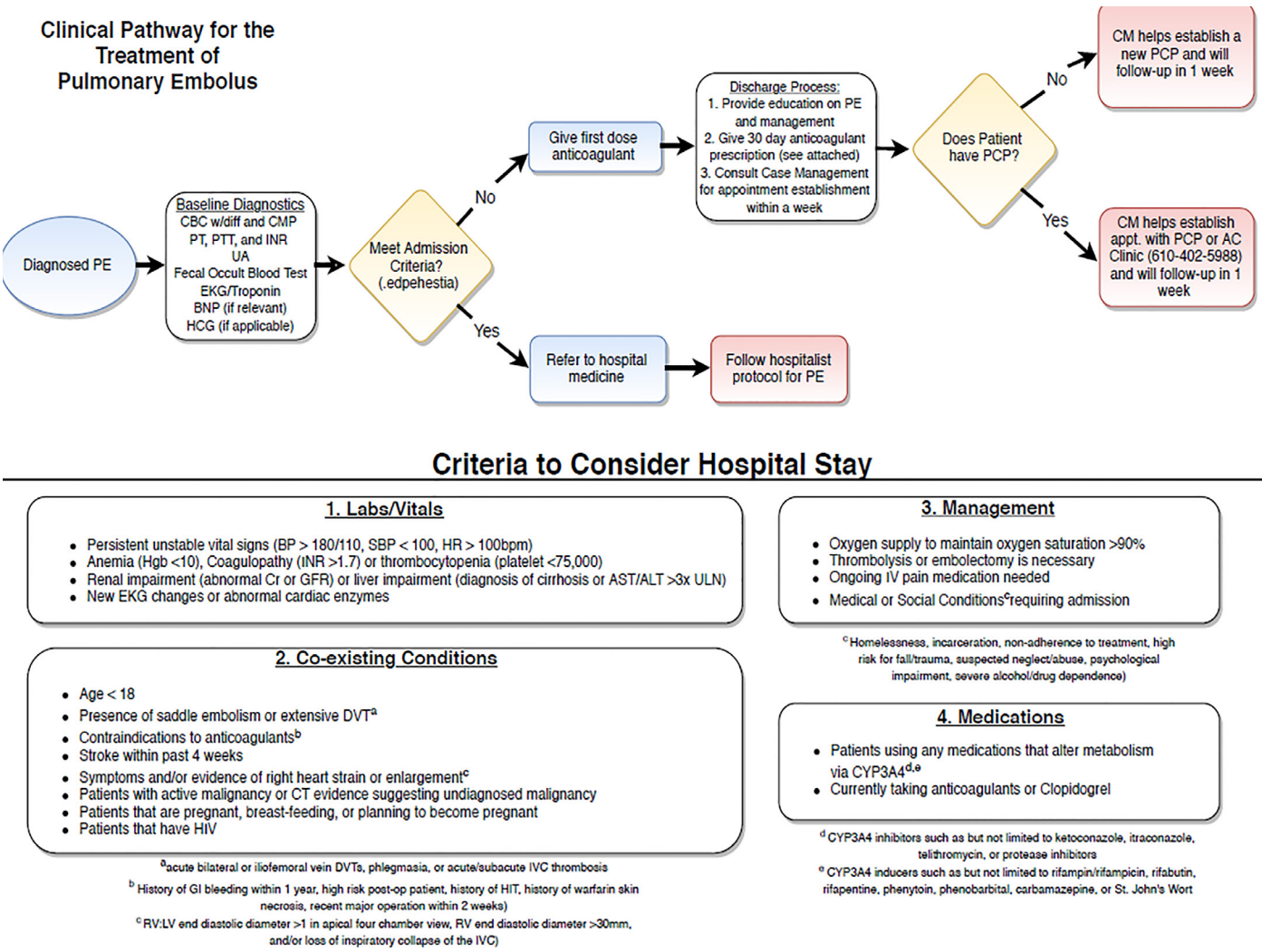


Figure 2. Pulmonary embolism pathway.

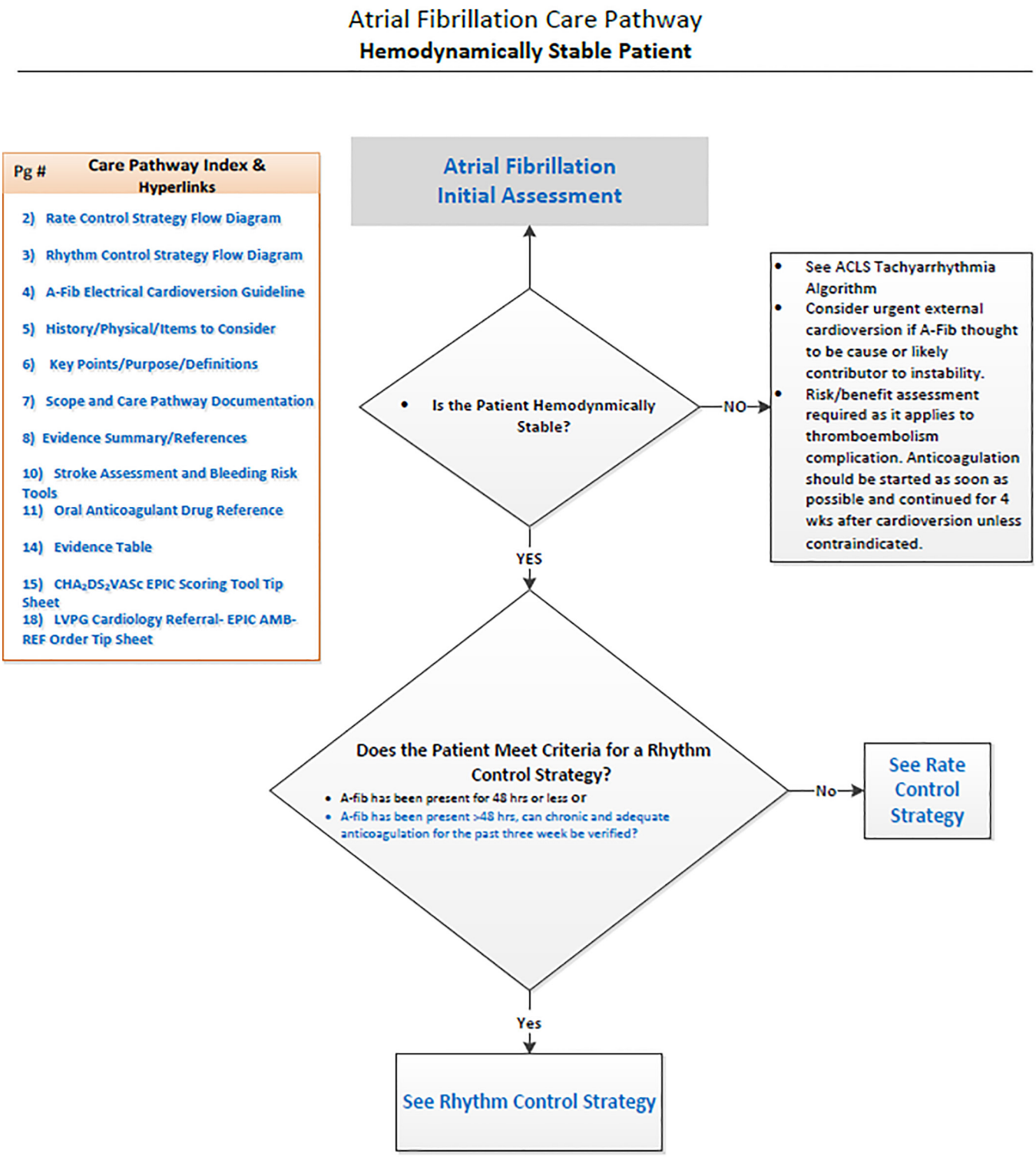


Figure 3. Atrial fibrillation pathway.

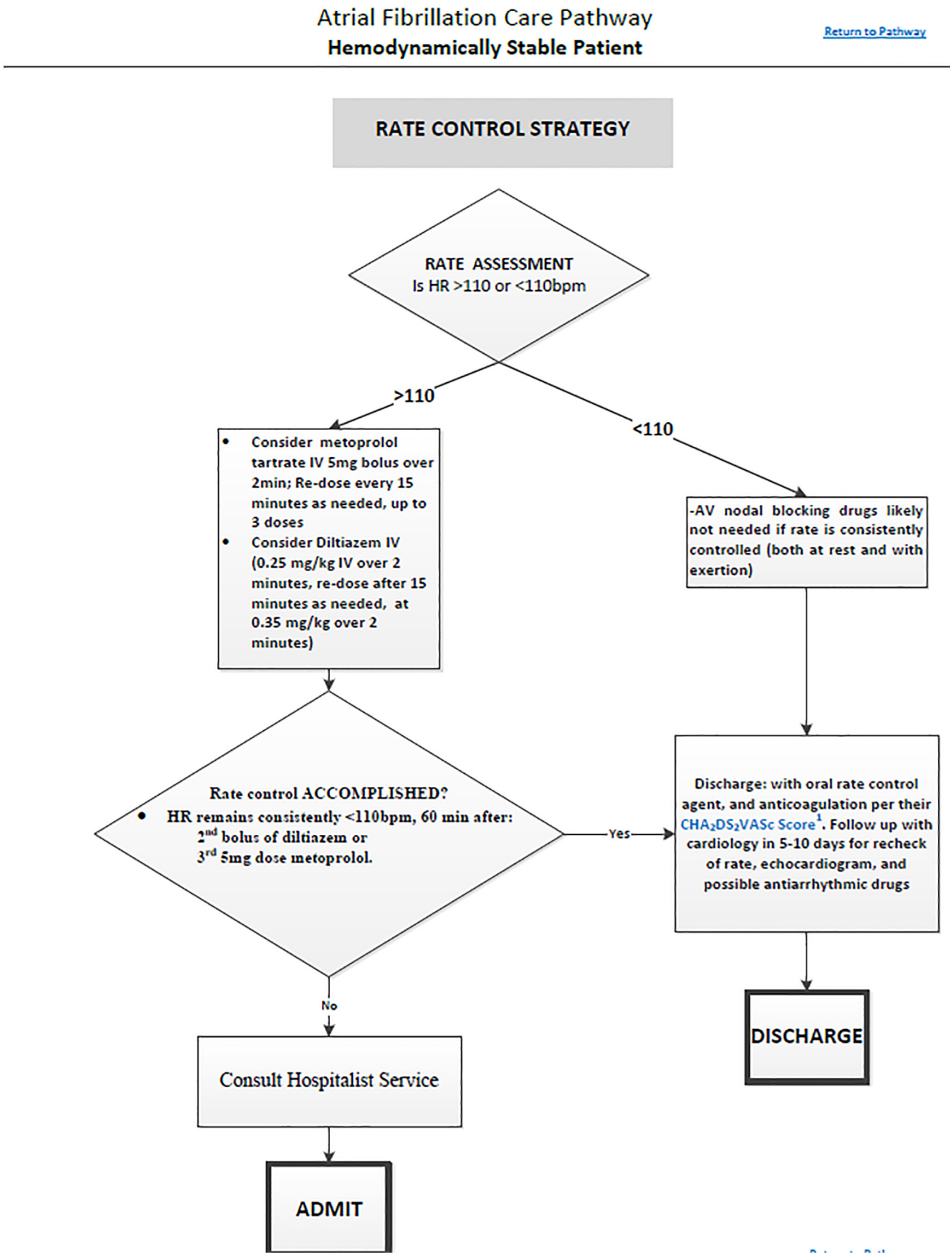
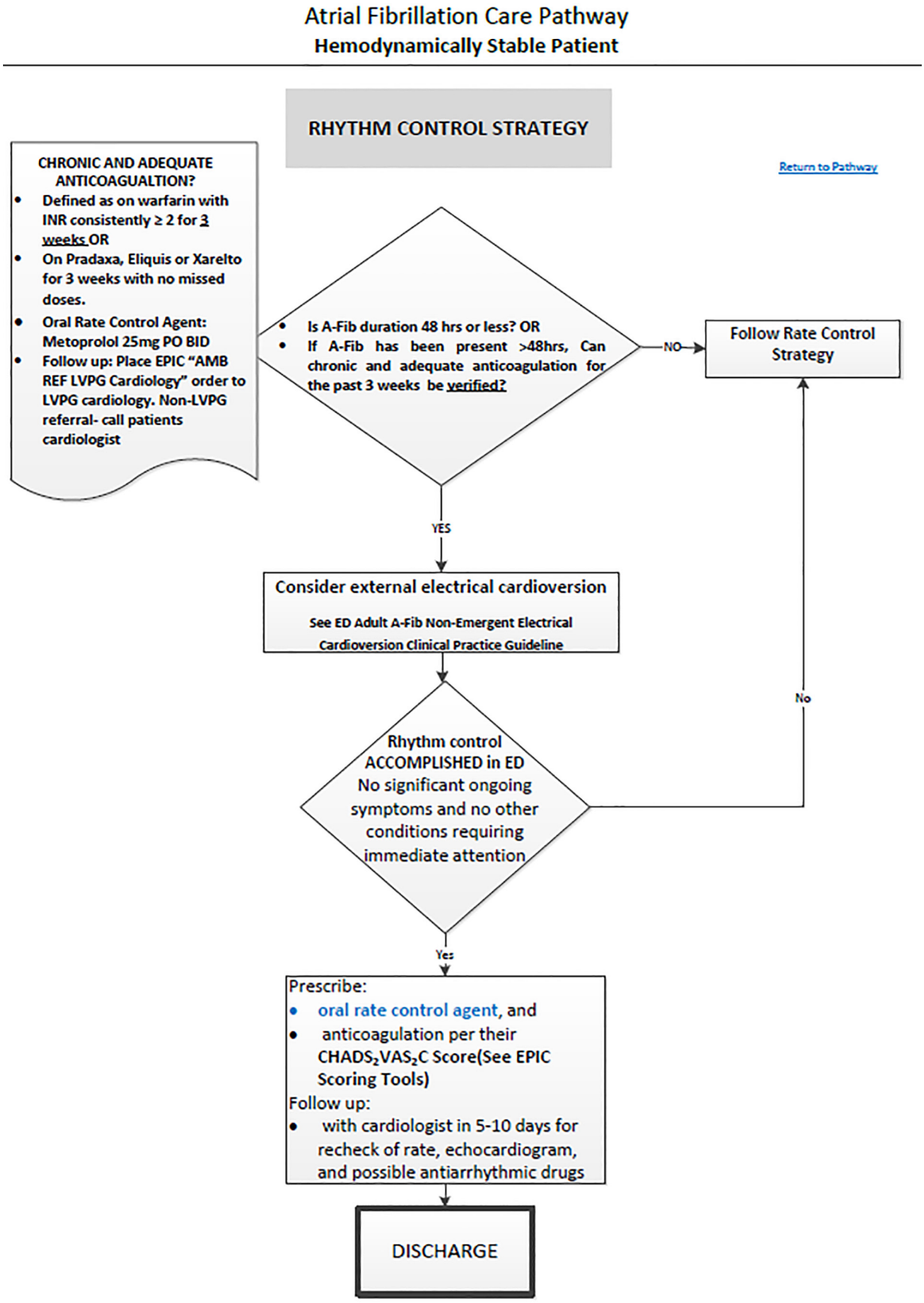


Figure 3. Continued.



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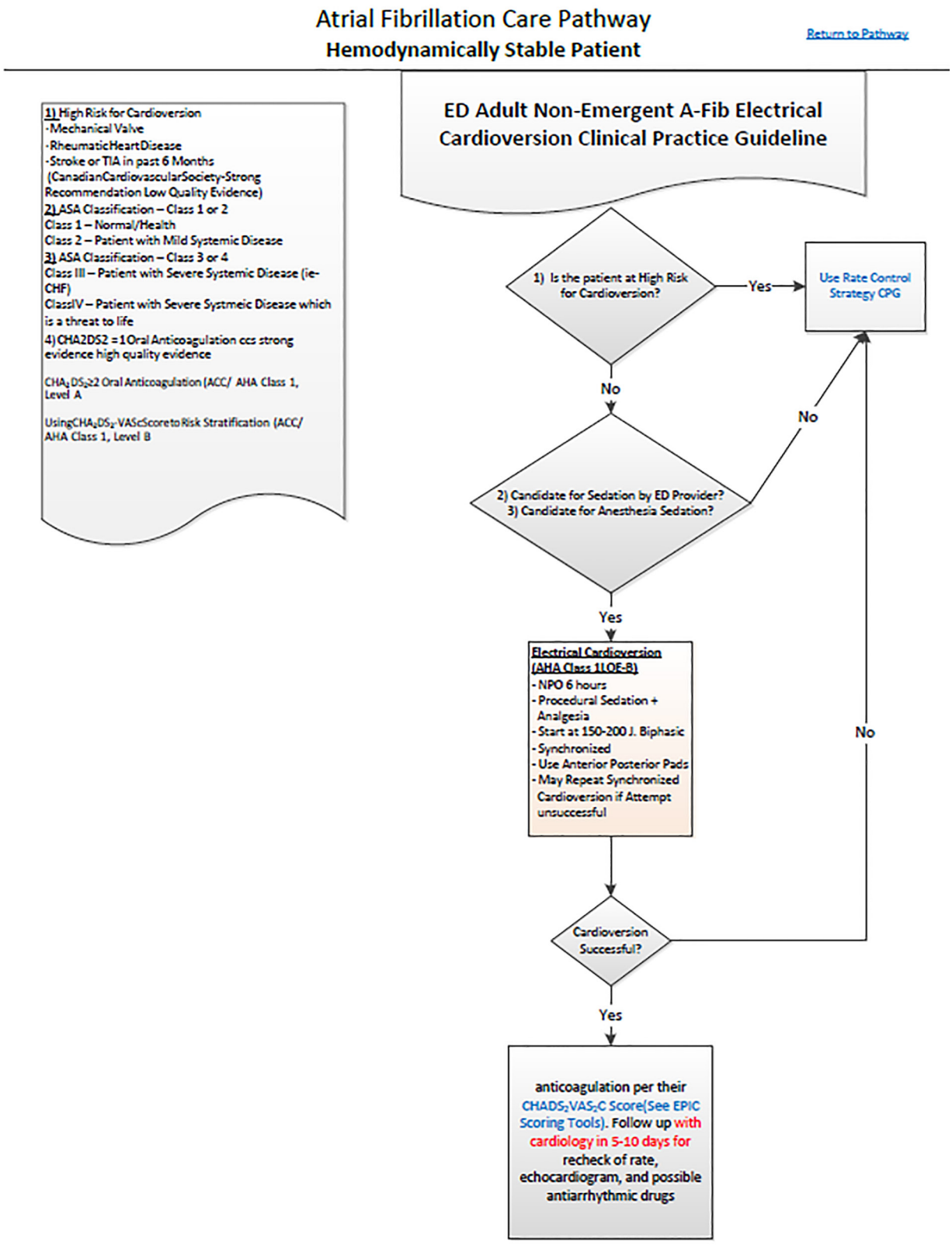

Figure 3. Continued.

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Exploratory Application of Augmented Reality/Mixed Reality Devices for Acute Care Procedure Training

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Introduction: Augmented reality (AR), mixed reality (MR), and virtual reality devices are enabling technologies that may facilitate effective communication in healthcare between those with information and knowledge (clinician/specialist; expert; educator) and those seeking understanding and insight (patient/family; non-expert; learner). Investigators initiated an exploratory program to enable the study of AR/MR use-cases in acute care clinical and instructional settings.

Methods: Academic clinician educators, computer scientists, and diagnostic imaging specialists conducted a proof-of-concept project to 1) implement a core holoimaging pipeline infrastructure and open-access repository at the study institution, and 2) use novel AR/MR techniques on off-the-shelf devices with holoimages generated by the infrastructure to demonstrate their potential role in the instructive communication of complex medical information.

Results: The study team successfully developed a medical holoimaging infrastructure methodology to identify, retrieve, and manipulate real patients' de-identified computed tomography and magnetic resonance imagesets for rendering, packaging, transfer, and display of modular holoimages onto AR/MR headset devices and connected displays. Holoimages containing key segmentations of cervical and thoracic anatomic structures and pathology were overlaid and registered onto physical task trainers for simulation-based "blind insertion" invasive procedural training. During the session, learners experienced and used task-relevant anatomic holoimages for central venous catheter and tube thoracostomy insertion training with enhanced visual cues and haptic feedback. Direct instructor access into the learner's AR/MR headset view of the task trainer was achieved for visual-axis interactive instructional guidance.

Conclusion: Investigators implemented a core holoimaging pipeline infrastructure and modular open-access repository to generate and enable access to modular holoimages during exploratory pilot stage applications for invasive procedure training that featured innovative AR/MR techniques on off-the-shelf headset devices. [West J Emerg Med. 2018;19(1)158-164.]

INTRODUCTION

Technologic advances have enabled commercially available virtual reality (VR) devices such as the HTC Vive and Oculus Rift to immerse end-users in convincing, artificial environments that (re-)create dramatic and engaging perceptual experiences through visual, auditory, and haptic

signals. However, these worlds are accessible only when users wear opaque VR goggles and relinquish several essential and interactive aspects of the physical realm of reality. In contrast, augmented reality (AR) overlays a supplemental digital realm *onto* the real world through various devices (*e.g.,* visors, smartphones), enabling users to continue to interact with their physical surroundings while simultaneously experiencing and interacting with digital objects and artifacts linked to actual environmental elements. (The associated concept of mixed reality [MR] encompasses all combinations of real, augmented, and virtual environments.[1]) A recreational yet acutely illustrative example is that of Pokémon Go (Niantic, San Francisco, CA), a popular mobile AR game in which players see and interact with digitally rendered creatures in video-captured, real-world landscapes on their AR device screens.[2]

Beyond consumer-focused uses such as gaming and social media, AR/MR technologies harbor dramatic potential for meaningful scientific application due to their ability to radically shift the way individuals interact with other people, places, objects, and ideas. Specifically, the representation and sharing of informative data through sophisticated visualization approaches is likely to blossom into an explosive phenomenon. AR/MR is already catalyzing healthcare and medical education, as it embodies an innovative and accessible approach for clinicians, patients, researchers, and educators to see, discuss, study, experiment, implement, and share complex concepts. Established examples in diverse fields include anatomy education,[3-5] general healthcare,[6-9] and procedural preparation or training for acute care medicine,[10-14] dentistry,[15] general surgery[16-20] neurosurgery,[21,22] ophthalmology,[23] orthopedics,[24,25] urology,[26] and vascular surgery.[27] Given this background, a team of academic clinician educators, computer scientists, and diagnostic imaging specialists conducted a proof-of-concept project to apply AR/MR to specialized acute care procedure training.

OBJECTIVES

Our goals were as follows: 1) Implement a basic holoimaging pipeline infrastructure with open-access repository to facilitate exploratory applications of AR/MR at the study institution and beyond; and 2) Use novel AR/MR techniques on off-the-shelf devices with holoimages generated by the infrastructure to demonstrate their potential role in the instructive communication of complex medical information.

METHODS

Curricular Design and Implementation for Exploratory Application

Program investigators structured an exploratory research framework to examine AR/MR's unique capabilities, implementation needs and barriers, and use characteristics in accessible, high-yield, best-case healthcare settings (Appendices 1a-1b). For one of the program's initial focus points for AR/MR clinical application, investigators proposed the use of AR/MR-enhanced instructional guidance to train emergency medicine (EM) learners in central venous line (CVL) placement and tube thoracostomy insertions, i.e., specific, common, invasive, and important acute care therapeutic interventions that feature consistent internal anatomic structures. As both procedures are performed with ultrasound guidance as the current standard of care, the training of acute care providers in "blind" CVL and tube thoracostomy insertions was targeted as a potential exemplar application of instructional AR/MR visualization in light of the potential for ultrasound device malfunction (*e.g.,* probe failure) and non-availability.[28-30] Updating and expanding on historic, landmark-based training that predated widespread ultrasound use, investigators planned to use AR/MR devices experimentally to combine 3D internal anatomic-model visualizations with interactive task training that featured haptic feedback and kinesthetic learning in real time at the educational bedside.

To set up the envisioned training application, the team accessed two department-funded, off-the-shelf HoloLens headsets ($3,000 per unit; Microsoft, Redmond WA) at a hospital simulation center. Specifically, these devices were used to expand an existing hands-on procedural teaching curriculum in place for EM fellows, residents, advanced practice providers, and medical students. We designed a two-hour pilot session to accommodate 40 learners for the "blind insertion" procedural training using two distinct and complementary approaches: 1) modular AR/MR holoimaging overlay and registration of patient anatomic structures and pathology onto procedural task trainers; and 2) first-person view visual-axis interactive instructional guidance. The institutional review board approved the project protocol.

Core Medical Holoimaging Pipeline Infrastructure and Open-Access Modular Holoimage Repository

Diagnostic imaging and computer science co-investigators collaborated with clinician educators to develop and assemble a medical holoimaging pipeline infrastructure with the following elements:

1) Query mechanism to identify, locate, and retrieve radiographic imagesets with specified clinical findings in the hospital network's Centricity Picture Archiving and Communication Systems (PACS; GE, Chicago IL) using mPower (Nuance, Burlington MA)
2) Imageset manipulation approach for de-identified, thin-slice, contrast-enhanced trauma "pan-scan" computed tomography (CT) volumetric imagesets to create modular and discrete regional segmentations of anatomic structures and pathologic findings of interest:
    2a. We extracted structures of interest with voxel intensity-based growing algorithms using an Advantage Workstation (GE, Chicago IL).

2b. We converted 3D scalar fields of structures of interest into polygonal mesh isosurfaces as an .stl file (3D Systems, Valencia CA) with a marching cubes algorithm, using iNtuition (TeraRecon, Foster City CA).

2c. We managed mesh smoothness and vertex counts using open-source MeshLab (ISTI-CNR, Italy) to fit within the processing capabilities of select AR/MR headset devices.

3) Compositing, rendering, and packaging process with differentiation of mesh model layers by color and synthesis of integrating holoimages using Maya software for export in .fbx format (Autodesk, San Rafael CA)

4) Transfer mechanism to move holoimages onto institution-approved secure network storage, cloud storage solution, and/or an open-access repository

5.) Retrieval and display procedure to access holoimages on AR/MR headset devices.

In its current implementation, the process pipeline required approximately 30 minutes for a typical head or chest CT imageset from the time of patient selection until holoimage display (the feasibility of partially automating holoimage processing is being studied). One specific advantage of developing this type of infrastructure was the ever-expanding repository of modular holoimages that can be subsequently retrieved and displayed, either as originally rendered or in assembled *holocomposites* that reflect patterns of pathology, e.g., combinations of multi-organ traumatic injury holoimages. At an administrative level, procedures and protocols for formalization of the infrastructure and dissemination mechanisms for institution-wide use are under development in parallel with discussions of staffing and funding arrangements. In the interim, approximately 20 of the developed holoimage .fbx files are accessibly stored on a storage cloud repository located at: https://repository.library.brown.edu/studio/collections/id_753/ (open access and download functionality).

Registered Overlaid Holoimaging for Anatomic Visualization

Overlaying real patients' holoimages of key cervical and thoracic structures onto physical task trainers was essential to provide learners with the equivalent of a "visible human" for the explicit purpose of conveying the locations, shapes, sizes, and juxtapositions of internal vascular and thoracic anatomic structures with respect to surface features. This was accomplished by displaying the rendered holoimages on the HoloLens units with 3DViewer Beta (Microsoft) during the practice insertion of invasive therapeutic devices (Figure 1). The holoimages were manually scaled and registered onto the CVL task trainer (Blue Phantom/CAE Healthcare, Sarasota FL) and tube thoracostomy-compatible SimMan 3G manikin (Laerdal, Wappingers Falls NY) using surface anatomy landmarks, e.g., sternal notch, laryngeal prominence, rib spaces. This permitted the stable overlay of task-relevant anatomy, e.g., internal jugular, carotid artery; ribcage, lung parenchyma, and pneumothorax, for training with enhanced visual cues and haptic feedback. A wirelessly networked laptop connected with the AR/MR device's built-in webportal system to broadcast the learner's view with superimposed holoimages for the viewer cohort.

Visual-Axis Interactive Instructional Guidance

The second instructional approach exploited wireless AR/MR-enhanced Skype video-conferencing (Microsoft) between the learner's HoloLens headset and an educator laptop with LCD projector. This arrangement was critical for accessing the learner's AR/MR headset view of the task trainer for visual-axis interactive instructional guidance, i.e., the introduction of educator-inserted 3D visual cues such as digital pointers and arrows. By using the headset's Skype functionality, the learner video-called an educator's laptop Skype application with HoloLens Add-in (with screen-mirroring projection of the learner FPV). This resulted in lagless sharing of the learner's procedural performance perspective along with the ability for both the learner and educator to "draw" into the shared view using an on-screen toolset, e.g., digital pencil tool or arrow tool. For environments without network connectivity or Skype, an alternative approach has been tested using an ad hoc device-laptop connection and Bluetooth-connected pointing device such as a wireless mouse to remotely direct the learner's attention (Figure 2).

RESULTS

Proof-of-Concept Simulation Session

Investigators successfully applied the described AR/MR holoimage visualization methodologies to a two-hour pilot session with approximately 40 learners. Four 30-minute breakout sessions (with two educators each instructing groups of 10 participants) were completed as part of a scheduled EM residency conference period; simulation and standardized patient scenarios were conducted in parallel sessions during the AR/MR-enhanced invasive procedural training. To emphasize anatomic visualization with AR/MR assistance and to review "blind insertion" techniques, the learners were intentionally not provided with ultrasound devices; standard approaches, equipment, and procedural kits were otherwise used for both procedures. All participants finished both task-training exercises without physical discomfort; formal objective metrics were not obtained during this proof-of-concept session. See Appendix 2 for .mp4 video of AR/MR headset first-person view of a de-identified patient's thoracic anatomy 3D model overlaid onto a patient simulator.

DISCUSSION

Investigators successfully piloted the use of off-the-shelf AR/MR devices to integrate holoimaging-enhanced anatomic visualization with acute care invasive procedure

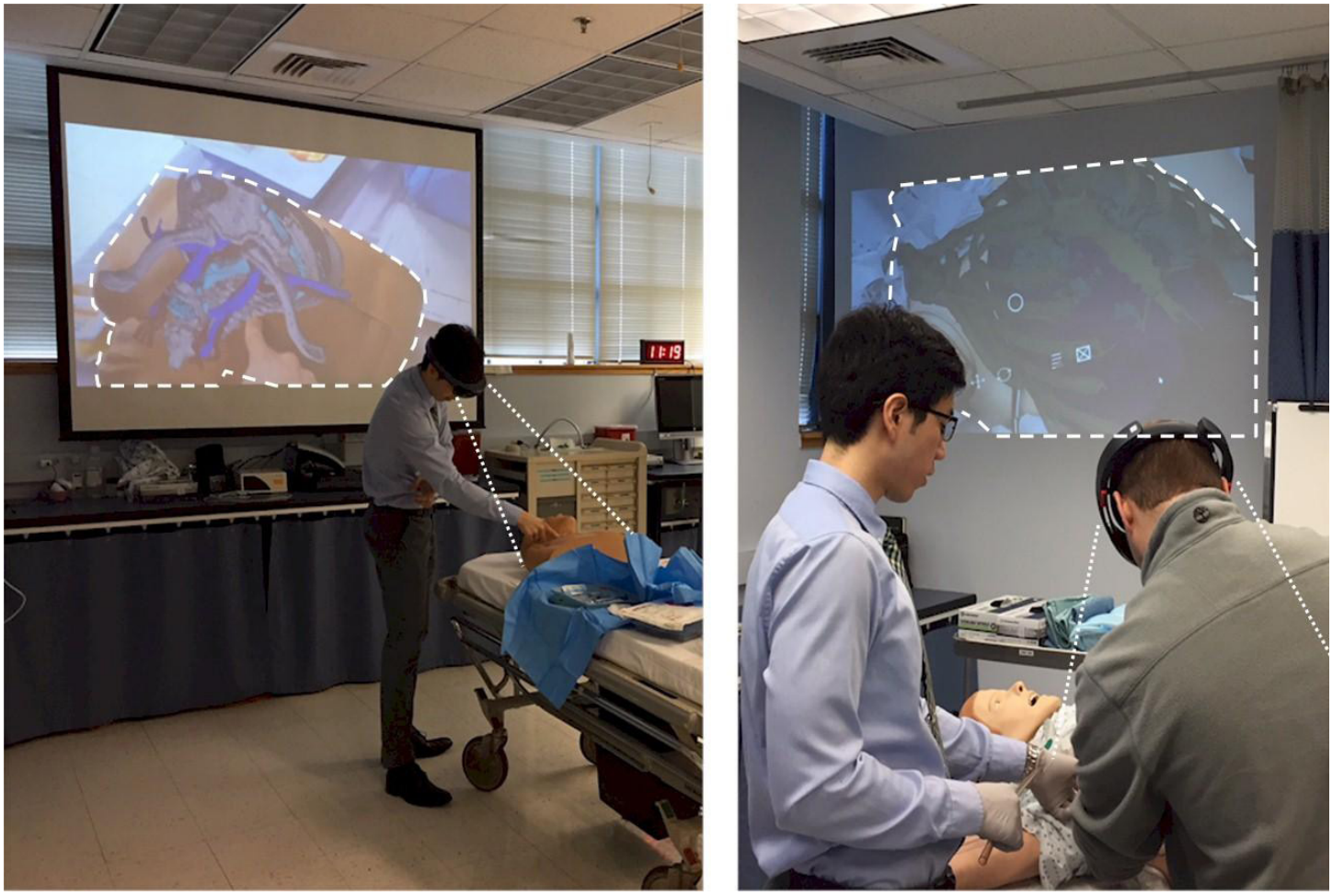

Figure 1. Left image: Wireless broadcasting of augmented reality/mixed reality (AR/MR) headset first-person-view videostream for shared anatomic visualization during central venous line training. Right image: AR/MR-enhanced tube thoracostomy training with highlighted outline of real-time projected visual overlay of pneumothorax and thoracic structures.

training. We developed and implemented novel methodologies, including a core institutional holoimaging pipeline infrastructure, open-access storage repository of modular holoimage segmentations, and visual axis instruction techniques, for education and research purposes.

Program researchers are continuing to explore AR/MR applications in acute care, surgical care, and medical science while concurrently working to formally study the utility and usability of the developed AR/MR methodologies in healthcare. As part of the research program's multiphasic strategy, investigations of AR/MR devices at the live clinical bedside are being prepared in peri-procedural settings: anatomic and diagnostic imaging AR/MR visualizations will be shown to patients and family members to gauge how the intervention facilitates discussions regarding management options and whether it assists with shared decision-making. Simultaneous, shared holoimage visualization across multiple headsets/viewers has already been accomplished at the study site; automation of holoimage registration with the real world for improved user experiences is being actively pursued.

With respect to future directions, the program team is pursuing ongoing use of AR/MR supplementation during EM residency sessions to objectively examine its educational utility for acute care procedural training. Defined metrics such as operational quality markers (e.g., holoimage registration accuracy, stability, and usability) and longitudinal, checklist-based procedural performance assessments in simulated settings will need to be established and validated. Additional acute care procedural training that could uniquely benefit from AR/MR-enabled anatomic referencing and guidance are being reviewed, e.g., arthrocentesis, epistaxis control, lumbar puncture, orthopedic manipulations, and complex wound exploration. Well-designed trials will be necessary to ascertain the effectiveness of AR/MR-based training and treatment interventions on live-patient clinical outcomes.

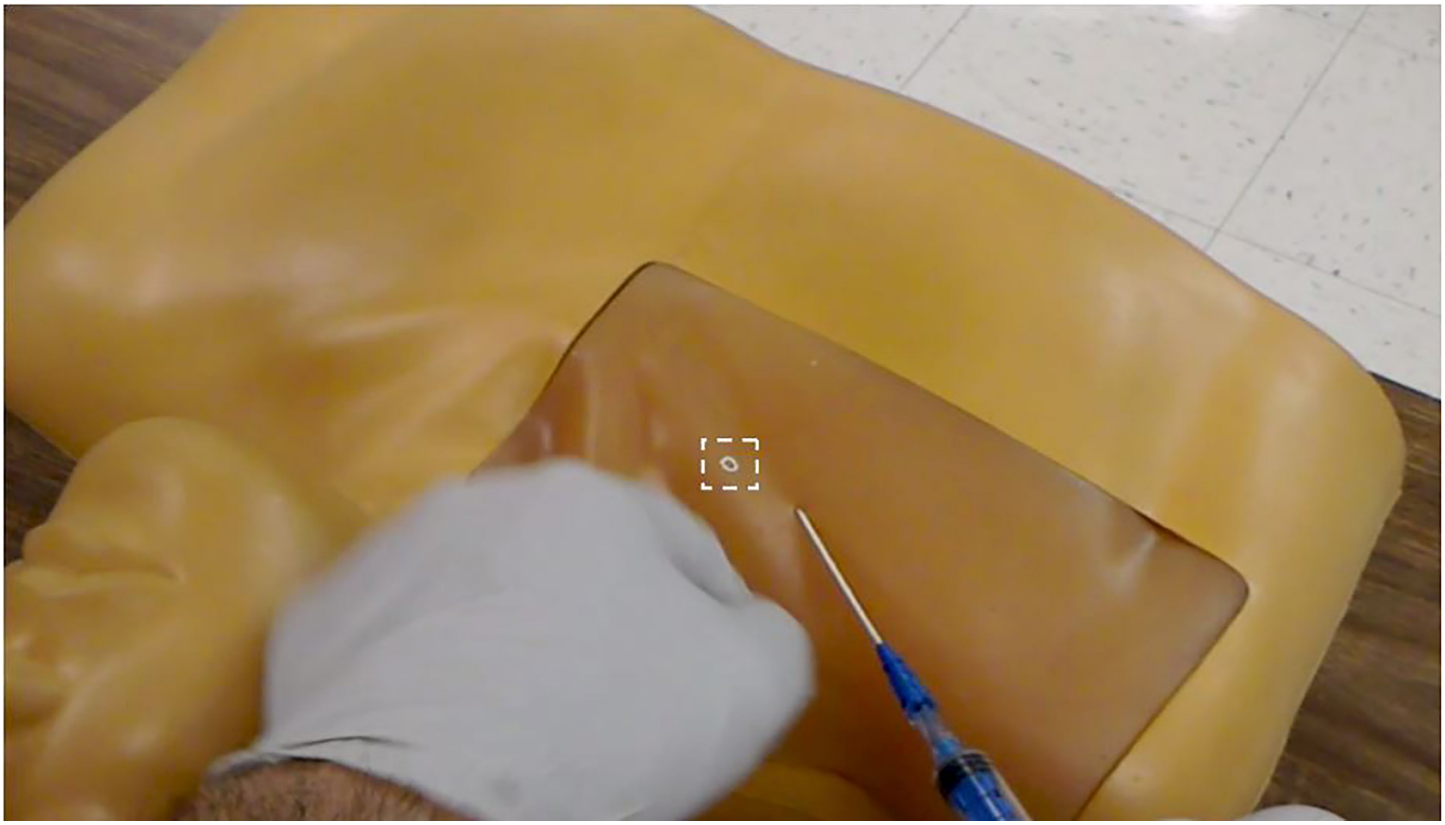

Figure 2. Still image of augmented reality/mixed reality (AR/MR) headset first-person view during visual-axis interactive instructional guidance for central venous line insertion training. The small pointer (highlighted by box outline) in the learner's visual field is controlled by the instructor and serves as a dynamic marker to help the learner position and direct the catheter for an optimal vessel cannulation approach.

By sharing developed materials through open-access publications and online digital repositories, the research team is working to promote intramural and extramural efforts for widespread and collaborative efforts to investigate AR/MR techniques and technologies. Such efforts, the resulting use-case explorations, protocols, standards, and technical advancements (along with the expected release of lower-cost headset devices from several manufacturers) are anticipated to begin laying the foundation for meaningful and judicious use of AR/MR in healthcare.

Limitations

The program's core holoimaging infrastructure was made possible by the significant in-kind efforts of co-investigators (DLM, SAC) with deep, authorized access into the institution's clinical diagnostic imaging systems. The primary operational limitation encountered by the research team derived from the manual overlay and registration process, in that the spatial alignment between the holoimage and the task trainer was intermittently lost and required adjustments. We did not assess or compare the effects of the experimental AR/MR approach on learner training and performance against existing methods during this initial pilot application. As a novel visualization approach that has only recently become more accessible to healthcare providers and researchers, holoimaging is anticipated to progress through the "hype cycle" framework,[31] with initial enthusiasm, media highlighting, followed by unrealistic expectations, disillusionment, and then eventual adoption with evolution of the technology.

CONCLUSION

Investigators have focused on the technical aspects of core system implementation, such that continued efforts will need to address the substantial work that remains in applying human factors engineering, ensuring institutional acceptance, and conducting empirical investigations into the clinical utility of holoimaging'. Previous work has already identified a variety of emergent AR-specific adverse effects in the clinical environment, e.g., distortion of real-world perception,[32] navigational and interface challenges,[33] and inattentional blindness.[34] Due diligence will be necessary to ensure its safe and effective application.

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Creating a Vision for Education Leadership

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BACKGROUND

Academic emergency physicians are driven to become master clinicians while honing their skills in mission areas such as education, research and administration. Many faculty members try to pursue the triple threat of education, service and research; however, excellence in all three areas is difficult to achieve. The first step to excelling in the education domain is to clearly define one's goals and articulate a strategy to achieve them. To be successful, you must define your vision, mission and core values (VMCV).

As the field of emergency medicine (EM) matures, its education leaders are increasingly recognizing the importance of defining personal and shared visions, core purpose (mission) and core values. In *The Leadership Challenge*, Kouzes and Posner explain "you must clarify your own vision of the future before you can expect to enlist others in a shared vision."[1, 2] The authors also summarize the benefits of leaders in organizations who are focused on the future, which includes achieving better performance outcomes both individually and as organizations. It comes as no surprise that most academic medical centers, medical schools and some emergency departments have developed shared visions and mission statements and have identified their core values. These statements highlight the core values of the institutions. Leadership experts such as Warren Bennis, Stephen Covey and Peter Senge emphasize the importance of developing your personal vision for life.[3,4,5]

This brief innovative report will provide tools and examples to articulate a vision statement for education leadership and the steps needed for implementation. The objective of this innovation is for the readers to develop their own vision, mission and core values, and to begin to consider how they will develop their strategy and platform for implementation. While these VMCV may be aligned with your organization's VMCV, it is important to define your own. Examples of VMCV from education leaders will be presented. This concept is based on a workshop from the Society for Academic Emergency Medicine (SAEM) in 2017 that was developed by key education leaders in the field of EM.

OBJECTIVES

This education innovation defines each domain of vision, mission, and core values. The reader is then directed through the steps to define their individual domains. Additionally, nine education leaders worked together to clarify their personalized statements.

1. Education leaders will be able to understand the definitions of VMCV and use these tools to create their personal VMCV.
2. Education leaders will adjust their VMCV to align with that of their division, department or organization.
3. Education leaders will use their VMCV to aid in decision-making and developing their strategic plan and future goals.

CURRICULAR DESIGN

This educational advance leads learners through the process of defining VMCV and then asking participants to determine their own vision, mission, and core values. This is then followed by participants determining their implementation strategy.

Developing Your Vision

Your personal vision should be the future state you hope to achieve. The vision statement should incorporate the future state and should be a positive, aspirational view of how the future will be better. Collins and Porras defined the vision as consisting of a core ideology and an envisioned future

where the core values are the guiding principles.[6,7] They went on to challenge people to create BHAGs, or "Big Hairy Audacious Goals," emphasizing that vision statements need to be something to strive for about 10 years in the future.

A stepwise approach can be helpful for developing a vision [8,9] starting by contemplating your purpose in the context of a positive future full of possibilities. This theme can be determined by asking yourself to describe your burning passion or what gets you up in the morning, or what do you envision every time you think about the future? Try and align the vision with that of your organization so that one builds on the other. Your vision should go forward several years and be inspirational, bold, exciting and define your burning passion. Transformational leaders are forward thinking, idealistic, possibility-thinkers and dreamers.

Nearly all recommendations for developing one's vision incorporate consideration and reflection of one's past, present and future.[1]

Review of one's past should especially include themes, patterns, experiences, and beliefs that have helped contribute to one's successes. Past experiences and successes also help define your most important core values. Attending to the present permits one to take inventory of hot topics or areas where futuristic change is clearly needed. Noting the specific details as well as the patterns pointing toward the future are keys to attending to the present.[1] The future can be considered by asking yourself what you want to accomplish and why? Dreaming or imagining the limitless possibilities in the future is particularly important in times of rapid change.

The final step is using these reflections, considerations, and ideas to articulate succinctly your one-sentence vision statement and then reviewing this often for direction, motivation and inspiration.

Examples of visions include that of Oprah Winfrey, founder of the Oprah Winfrey Network, who articulated her vision this way: "To be a teacher. And to be known for inspiring my students to be more than they thought they could be."[10] Amanda Steinberg, founder of DailyWorth.com wrote her vision: "To use my gifts of intelligence, charisma, and serial optimism to cultivate the self-worth and net-worth of women around the world."[10]

Developing Your Mission

The mission statement or purpose should be a concise statement that describes how you will get there and your reason for being. This is the path by which you will achieve your vision. The mission statement should describe what you want to be and do in your profession and how you will accomplish your vision. It should answer questions about what you will do, who it is for and how you will do it. The most classic examples of a core purpose can be seen from organizations such as the Walt Disney Company: "To make people happy;" and Merck & Co Inc, "To preserve and improve life."[2]

Developing Your Core Values

Core values help to align your vision and mission and should include the 3-5 values that serve as your guiding principles. Collins and Porras describe organizational core values as the "essential and enduring tenets of an organization."[6] The core values of Disney are "imagination and wholesomeness." Kouzes and Posner describe individual core values as the deeply held beliefs – the values, standards, ethics, and ideals – that drive you."[1] You will use these core values to guide decisions and actions. They are your personal "bottom line."[1]

Developing Your Implementation Strategy

Your strategy is the method by which you will achieve your vision and mission. This is the practical part of the plan where you think about the goals to be achieved and how you will get there. It is focused on the methods that you feel will be important for accomplishing vision and mission. It is your blueprint that will incorporate specific goals for your success. Your platform is the media or milieu in which you function most effectively. For example, for many education leaders, their platform is social media, while for others it is their personal learning network.[11,12]

IMPACT / EFFECTIVENESS

The table displays the VMCV of several education leaders. Each is unique and approaches education from a different perspective. Some of the education leaders focused more at an organizational level, while others were more narrowly focused. Recent evidence has demonstrated a positive association between well-written mission statements and non-profit healthcare sector performance and firm performance.[12,13] The Gallup organization's research has demonstrated "success-promoting" and "margin-boosting" benefits of focusing on mission.[14] They believe that mission drives loyalty, fosters customer engagement, improves strategic alignment and brings clarity by guiding decision making.

In a study by Berg he described an intense commitment to "making the world a better place" that was "almost spiritual" in an organization when symbiotic visions and goals could drive employees and organizations.[15] Similar recommendations regarding the importance of aligned vision, mission and values have surfaced in healthcare as well.[16] In a publication by pediatric program directors, personal mission statements were recommended to maintain focus and aid in decision-making and strategic planning to empower academicians to make appropriate trade-offs and

Table. Vision, mission, and core values of selected education leaders.

Education leader	Vision, mission, & core values
Felix Ankel, MD VP, Health Professions Education Healthpartners Institute Professor of Emergency Medicine University of Minnesota Medical School	Vision: Health as it could be, affordability as it must be, through relationships built on trust. (adapted from https://www.healthpartners.com/hp/about/) Mission: To improve health and well-being in partnership with patients, learners, and community. Core Values: Excellence, compassion, partnership and integrity
Robin Hemphill, MD, MPH Chief Patient Safety Officer Director of the National Center for Patient Safety Veterans Health Administration	Vision: Zero preventable harms Mission: Safety through high reliability concepts Core Values: Excellence
Sheryl Heron, MD, MPH Vice Chair of Administrative Affairs Emergency Medicine Assistant Dean of Clinical Education & Student Affairs Emory School of Medicine	Vision: Quality care inclusive of all people for all people regardless of their background. Mission: Advancing diversity, equity and inclusion through engagement of key organizational stakeholders Core Values: Professional and personal connections
Daniel Martin, MD, MBA Professor and Vice Chair of Education EM IM Residency Program Director Department of Emergency Medicine The Ohio State University	Vision: To develop, enlighten and empower others to positively impact patients, learners and colleagues through their passion for education, innovation and leadership. Mission: To use a lens of education and innovation to engage and motivate learners to provide the best education and care possible to our patients. Core Values: Culture of integrity and trust, positive approach, connecting with others, use humor whenever possible
Chris Merritt, MD, MPH Pediatric Residency Program Director Assistant Professor of Emergency Medicine & Pediatrics Alpert Medical School of Brown University	Vision: Sustainable child health, excellence in care of ill and injured children anytime, anywhere. A networked community of lifelong learners and advocates. Mission: To empower newcomers to a community of practice, supported by systems of learning, such that they can contribute to the advancement of the common attitudes, interests and goals of our patients and communities. Core Values: Personal relationships, positivity, humor, continuous improvement.
Sorabh Khandelwal, MD Samuel Kiehl III Professor of Emergency Medicine Residency Program Director Department of Emergency Medicine The Ohio State University	Vision: Flourishing Department and Organization Mission: Promoting resident and faculty development into flourishing individuals to improve learning, academic productivity, patient care, and personal and professional relationships. Core Values: Forgiveness, gratitude, be present, hope, faith, optimism
Sally Santen, MD, PhD Senior Associate Dean of Evaluation, Assessment and Scholarship Virginia Commonwealth University School of Medicine	Vision: Improving health through education Mission: Learner centered, Evidence based, outcomes oriented, continuous improvement, scholarship focused Core Values: Serve, learn, team
Mary Westergaard, MD Vice Chair of Education Emergency Medicine Residency Program Director University of Wisconsin	Vision: Inspiring learners to achieve a higher standard of care: for patients, for the practice of medicine, and for themselves. Mission: To guide learners to fulfillment, and training programs to excellence by attending to humanistic principles. Core Values: Modelling the way, promoting and sponsoring, valuing curiosity, challenging injustice

reach for new opportunities that were well aligned, while eliminating or declining things that were not.[9]

This innovation provides a stepwise approach for readers to define their vision, mission, and core values. Several examples are described. In general, following preparation, a 60- to 90-minute session like that of the SAEM can be used to develop an initial draft of these statements. Evaluations of the SAEM session noted that all participants noted increased ability to describe vision, mission, strategy and platform afterward. A similar session was used by first-year medical students during "Mission Statement Day."[17]

First, it is important to remember that the process of

creating these statements is not necessarily straightforward. Sometimes it is difficult to identify the key features that belong in the VMCV. Although most references describe the importance of vetting these statements to peers, mentors or supervisors,[9] it can be unsettling to share these intensely personal statements for fear of criticism. It is particularly hard to create a BHAG. The time spent struggling with the VMCV is time well spent. This investment of your time will help you find a direction by which you can influence and lead in your focus area of education.

Second, it is important to remember that the VMCV are not static. While you may choose to stand with an original vision, it is common to have adjustments as the context changes. Therefore, returning to your statements can be helpful especially in times of transition, as well as to reset or reframe your goals. Finally, some leaders choose to keep their VMCV private while others espouse them publicly. Regardless of how open you choose to be with your VMCV, it is most important that your behaviors demonstrate these statements. Moreover, most leaders operate within a social network; therefore, ensuring that the people you work with know your VMCV is key to teamwork and success.

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Calling All Curators: A Novel Approach to Individualized Interactive Instruction

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With the increasing influence of the "Free Open Access Medical Education" (FOAM or FOAMed) movement, it is critical that medical educators be engaged with FOAM in order to better inform and direct their learners, who likely regularly consume these materials. In 2012, the Accreditation Council for Graduate Medical Education (ACGME)/Residency Review Committee (RRC) began to permit 20% of emergency medicine (EM) residents' didactics hours to be earned outside of weekly conference, as "Individualized Interactive Instruction" (III) credits.[1] We describe a digital course in EM, "Asynchrony," as an approach to FOAM to meet these III standards. Asynchrony is geared toward EM residents using FOAM and other online learning tools, curated by faculty into narrative, topic-specific educational modules. Each module requires residents to complete a topic assignment, participate in a discussion board, and pass a quiz to earn ACGME-approved III didactic credit; all of this is tracked and filed in an online learning management system. [West J Emerg Med. 2018;19(1)169-171.]

INTRODUCTION

The Free Open Access Medical (FOAM) education movement has become an increasing presence in emergency medicine (EM).[2] Many residents and medical students regularly consume online educational blogs, podcasts, or other digital educational resources, usually without any faculty guidance or oversight.[3] While some of these resources are peer-reviewed and of very high academic quality, tools for the critical evaluation of these resources are evolving. Many medical educators are concerned that their learners are being influenced by unvetted sources and celebrity purveyors of medical "edutainment."[4]

Educators who are regularly engaged with FOAM resources may be in a unique position to serve as curators and translators of this world for their trainees. In a recent commentary in the *Canadian Journal of Emergency Medicine*, the authors proposed three types of scholars for this new era of evidence-based medicine: the "critical clinician," the "translational teachers," and the "interactive investigators."[4] The "translational teachers" include, among others, educators who strive to improve clinical practice of their learners by shortening the "knowledge translation window" – that is, assisting the scientific community in disseminating new knowledge to learners, with the help of modern educational tools such as social media, blogging, or podcasting.[4]

To be a "translational teacher," one need not create these educational tools from scratch. Curation and presentation of high-quality digital materials to learners under faculty direction can help satisfy millennial learners' desire for digital, asynchronous and on-the-go learning, while keeping educators from having to re-invent the wheel.

METHODS

The details of how residency programs could adopt novel Individualized Interactive Instruction (III) opportunities were not clearly delineated by the Accreditation Council for Graduate Medical Education (ACGME). Many residency programs took different approaches. In 2014, our program sought to create a digital course, "Asynchrony," as a new approach to FOAM and other popular digital content, vetting and interpreting it for our learners, while simultaneously meeting the ACGME's

four criteria for III:[1]

1. The program director must monitor resident participation.
2. There must be an evaluation component.
3. There must be faculty oversight.
4. The activity must be monitored for effectiveness.

The Asynchrony Course

This is the third year of the course entitled "Asynchrony" at our institution. Using our medical school's online learning management system (LMS) we designed a faculty-led digital III course in EM, mapped to our residency's curricular calendar. This course provides faculty perspective for trainees who consume FOAM resources, while allowing residents to earn ACGME-compliant III credit.

Weekly or bi-weekly modules each cover a particular EM educational topic. Each module is divided into an assignment page, a discussion page, and a 10-question, multiple-choice quiz. The assignment page is designed to be completed in one hour (or two hours if it is a longer, bi-weekly module).

The Assignment Page

Faculty search for, evaluate, and accept or reject applicable clinical content resources in a variety of digital formats (podcasts, blog posts, video posts, radiologic images, journal article links, online textbook entries). Because this course is designed for all post-graduate learners in EM, faculty also aim to evaluate content for applicability to varied levels of learner experience (balancing basic content and more advanced articles/practice controversy).

The curated material is then assembled into an informal, engaging narrative (including a theme song using a play on words related to the content, just for fun). The educational content is accessed through hyperlinks woven into the narrative, and the faculty give commentary on what is assigned when they feel it is necessary.

Because the FOAM world is often lacking in quality material for less "exciting" core content,[5] faculty may use online journal articles or reviews, podcasted lectures, or links to our university's e-library to fill in perceived gaps. "Optional Extras" are also included, which can include lay press articles, tangentially related fun facts, links to additional resources, or human-interest stories related to conditions being discussed in the modules.

Some open-access example assignment pages can be viewed on our educational blog at www.brownemblog.com/asynchrony.

The Discussion Page

Once the assigned content is reviewed and completed by the residents, they navigate to the discussion board. Participation on the discussion board is mandatory, which opens the gate to the quiz. To encourage participation from all levels of learners, several leading queries are provided for the resident to choose; some are general, and others require more advanced expertise. The faculty member monitors and facilitates the discussion; approximately 20 faculty participated on the discussion boards in the first year of the course. Multiple faculty experts may be tapped for answers to resident questions posted on the board.

The Quiz

The online quiz includes 10 multiple-choice questions, written by the faculty curator for that module. All residents have three tries to pass the same quiz; 8/10 earns them III credit. The credits are logged automatically by the LMS. The LMS also tracks residents' performance on individual questions, as well as pooled data for all respondents to each question, for troubleshooting purposes.

RESULTS

Survey data from the first year of use with 33 of our 48 residents responding an overall 4 or 5 on a 1-5 scale (5 being excellent), described the program as follows: on ease of use (mean 4.15); quality of content (mean 4.58); variety of content (mean 4.58); resources used (4.36); and appropriateness of time spent doing the activity (mean 4.03). Some residents felt the modules took too long to complete (per one resident's survey comment, "very well put together, but they take longer than the one hour of conference they are replacing."). However, some residents stated they preferred the online format to traditional weekly conference (e.g., "Finally, a place that utilizes the incredible online resources available that are much better done than most presentations.").

The Asynchrony program is optional, but interestingly, in the survey comments several of the residents requested that it become mandatory (e.g. "They are amazing. I wish we had a structured requirement for its use."). We currently have five hours of live weekly conference, with Asynchrony as an additional option to use for up to 20% of the annual conference hours requirement.

As one might expect due to the optional nature of the course, there are some residents who engage every week, others who "binge" on several modules every month or two, and others who do not ever participate. Likewise, there are faculty who are active on the discussion boards or interested in creating modules, and others who eschew the electronic format completely.

When queried about barriers to participation, lack of time was the most common reason cited.

Based on survey results, changes this year have included a trial of longer, bi-weekly modules for two hours of III credit, as well as placement of selected assignment

pages as open-access material on our blog, which other EM programs may use if desired.

A video example of an actual module within our LMS is available at https://www.youtube.com/watch?v=GLh082URR0k&t=2s.

CONCLUSION

The Council of Emergency Medicine Residency Directors (CORD) III Task Force released a post on "Best Practices in III" in June 2016.[6] The advantages of implementing a course similar to Asynchrony include the following:

1. Faculty curation of FOAM/digital resources ensures content quality, and helps faculty stay up-to-date as well.
2. Faculty can fill in gaps not covered by FOAM.[5]
3. Interactive nature fulfills III Best Practices,[6] gives perspective, and allows residents to ask questions of trusted sources.
4. Residents earn III credit for work they may have already been doing.[3]
5. Material can be assembled into a cohesive, ordered curriculum, unlike the piecemeal manner in which FOAM is normally consumed.
6. Quiz scores, interactions, and credits are tracked via the LMS.

Potential barriers and limitations include these:

1. Commitment – Asynchrony requires a faculty champion (committing several hours per week), time of other faculty contributors, and familiarity with an online LMS
2. Participation – If not mandatory, not all residents or faculty will regularly participate
3. Time constraints – Content required to fully explore a topic may take residents longer than one hour to complete.

Asynchrony aspires to be an informative, entertaining resource for our residents. It would be easily replicable at other institutions and creates a cohesive system integrating multi-media digital learning and FOAM into residency education.

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Development of a Novel Ultrasound-guided Peritonsillar Abscess Model for Simulation Training

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Introduction: Peritonsillar abscess (PTA) is the most common deep space infection of the head and neck presenting to emergency departments.[1] No commercial PTA task trainer exists for simulation training. Thus, resident physicians often perform their first PTA needle aspiration in the clinical setting, knowing that carotid artery puncture and hemorrhage are serious and devastating complications. While several low-fidelity PTA task trainers have been previously described, none allow for ultrasound image acquisition.[6-9] We sought to create a cost-effective and realistic task trainer that allows trainees to acquire both diagnostic ultrasound and needle aspiration skills while draining a peritonsillar abscess.

Methods: We built the task trainer with low-cost, replaceable, and easily cleanable materials. A damaged airway headskin was repurposed to build the model. A mesh wire cylinder attached to a wooden base was fashioned to provide infrastructure. PTAs were simulated with a water and lotion solution inside a water balloon that was glued to the bottom of a paper cup. The balloon was fully submerged with ordnance gelatin to facilitate ultrasound image acquisition, and an asymmetric soft palate and deviated uvula were painted on top after setting. PTA cups were replaced after use. We spent eight hours constructing three task trainers and used 50 PTA cups for a total cost <$110.

Results: Forty-six emergency medicine (EM) residents performed PTA needle aspirations using the task trainers and were asked to rate ultrasound image realism, task trainer realism, and trainer ease of use on a five-point visual analog scale, with five being very realistic and easy. Sixteen of 46 (35%) residents completed the survey and reported that ultrasound images were representative of real PTAs (mean 3.41). They found the model realistic (mean 3.73) and easy to use (mean 4.08). Residents rated their comfort with the drainage procedure as 2.07 before and 3.64 after practicing on the trainer.

Conclusion: This low-cost, easy-to-construct simulator allows for ultrasound image acquisition while performing PTA needle aspirations and is the first reported of its kind. Educators from EM and otolaryngology can use this model to educate inexperienced trainees, thus ultimately improving patient safety in the clinical setting. [West J Emerg Med. 2018;19(1)172–176.]

BACKGROUND

Peritonsillar abscess (PTA) is the most common deep space infection of the head and neck presenting to emergency departments (ED).[1] Draining a PTA is straightforward and can be accomplished with needle aspiration, incision and drainage, or tonsillectomy. With a cure rate of 93-95%,[1] needle aspiration is the most common approach, does not require special equipment, and is relatively simple and inexpensive. However, physical exam alone has not been shown to reliably differentiate between PTA and cellulitis, and blind needle aspiration has a reported false

negative rate of 10-24%.[2-3] The addition of intraoral ultrasound can improve diagnosis (sensitivity 89-95%; specificity 79-100%)[4] and aid in the safe performance of needle aspiration. In a prospective, randomized, controlled trial comparing the diagnostic accuracy of emergency providers for detecting PTA or cellulitis using intraoral ultrasound or landmark technique, ultrasound established the correct diagnosis more often and led to more successful aspiration of purulent material than landmark technique. Additionally, the average number of needle punctures was lower in the ultrasound than landmark group.[5]

Currently, no commercial PTA task trainer exists for simulation training, and thus resident physicians often perform their first PTA needle aspiration in the clinical setting, with the knowledge that carotid artery puncture and hemorrhage are serious and devastating complications. Thus, simulating PTA needle aspirations with a realistic model that allows for ultrasound image acquisition and procedural competence can build confidence and proficiency prior to performing this procedure in patient care. While several low-fidelity PTA task trainers have been previously described,[6-9] none allow for ultrasound-guided diagnosis and management, which is the preferred strategy in the ED setting for patient safety and comfort, and all have limitations ranging from ease and stability of construction to anatomic fidelity.

OBJECTIVES

We sought to create a cost-effective and realistic task trainer that allows trainees to acquire both diagnostic ultrasound and needle aspiration skills while draining a PTA.

CURRICULUAR DESIGN

We built the task trainer with low-cost, replaceable, and easily cleanable materials. A damaged Laerdal© Adult Airway Management Trainer headskin with airways, teeth, and naturally occurring trismus was repurposed to build the PTA model. We fashioned a mesh wire cylinder attached to a wooden base to provide internal structure and access to the posterior oropharynx. PTAs were simulated with a water and dimethicone barrier lotion solution inside a thin latex water balloon that was glued to the bottom of a paper cup, as described by Bunting et al.[3] The balloon was fully submerged with Vyse Ordnance Gelatin (pork gelatin/hydrolysate) to facilitate ultrasound image acquisition. An asymmetric soft palate and deviated uvula were painted on top of the gelatin mold after it was allowed to set in a refrigerator overnight. PTA cups were replaced after each successful needle aspiration, as water balloons only tolerate one needle puncture each.

Materials required can be purchased from a hardware store or Amazon (Table). Detailed construction instructions follow. A complete pictorial guide can be found at http://escholarship.org/uc/uciem_westjem (See Supplement).

Construction

1. Prepare the headskin. Headskins with teeth and a tongue that are ready to be discarded from any airway task trainer or mannequin can be used.
   a.) From the inside of the headskin, remove the trachea, bronchi, and any other anatomic parts until only the tongue and internal frame remain. Cut a slit at the base of the tongue to allow a craft stick to be slotted in and for zip-tie attachment to internal frame.
2. Prepare the supportive stand (Figure 1a). The purpose is to provide structure to the floppy headskin while also allowing easy access to the posterior oropharynx through the mouth for the trainee and from the back for the facilitator.
   a.) Cut hardware cloth to the height needed* to support the head in an upright position. Wrap hardware cloth around one 4" PVC sewer and drain fitting* to ensure fit. Two layers of cloth are suggested for added stability. Secure the mesh cylinder with the surplus bailing wire packaged with the

Table. Materials for peritonsillar abscess model.

3 Task trainer heads and internal support		100 Peritonsillar abscess cups (replaceable)	
Total cost	$46	Total cost	$59
Discarded headskin	$0 each	Dimethicone barrier lotion	$10
Hardware cloth	$16	Water balloons (500 ct)	$5
PVC sewer and drain fitting, 4" outer diameter	$3.50 each	Craft sticks (100 ct)	$5
NDS drain grate, 4" inner diameter	$2.80 each	8oz paper ice cream cups (100 ct)	$17
Duct tape	$3.50	Cyanoacrylate glue	$3
Zip ties	$3	600oz ballistic gelatin	$13
Utility hook hangers & screws	$4	Food coloring	$2
Scrap plywood	$0	Cotton balls/pads	$2
Scrap foam or towels	$0	Paint	$2

PVC, polyvinyl chloride; *NDS*, national drainage system.

hardware cloth.

b.) Using wire cutters, remove a posterior portion of the cylinder wide and high enough* for a facilitator to place and hold a PTA cup at the level of the mouth opening. Similarly, remove an anterior portion* of the cylinder to allow easy access to the PTA cup through the mouth. To prevent injury, use duct tape to cover the exposed metal edges.

c.) Position the 4" PVC sewer and drain fitting at the level of the base of the tongue*, aligning with the inferior aspect of the posterior and anterior openings, thus creating a platform on which the PTA cup is placed. Zip tie the drain fitting in place to the cylinder. Cap the top of the cylinder with one NDS 4" drain grate* to provide support to the top of the head and prevent bowing. Zip tie in place.

d.) Affix the cylinder to scrap plywood using utility hook hangers and screws, or similar. Secure the cylinder to the headskin's internal frame with zip ties at multiple points, including through the slit made at the base of the tongue. This is crucial to maintaining an upright and anterior position of the PTA cup when the mouth is opened by the learner during the procedure. If desired, fill the cranial space above the cylinder with scrap foam or towels to provide structure to the head.

3. Prepare the peritonsillar abscess (Figure 1b).

a.) Combine water and dimethicone barrier lotion to desired viscosity. Ensure simulated abscess material can be aspirated through an 18g spinal needle. Inject approximately 7ml of material into a small water balloon and tie closed.

b.) Glue the balloon to the bottom of an 8oz paper ice cream cup with cyanoacrylate glue. Mark the location of the PTA balloon on the underside of the cup.

c.) Tape half of a craft stick to the inside of the cup inferior to the abscess to ensure proper orientation in the airway head. Cover the balloon with a layer of cotton to obscure the balloon.

d.) Prepare ballistic gelatin. Combine 100g of gelatin powder per 800ml of water in a glass beaker and stir. Place beaker into heated water bath of at least 75C and allow to sit for a minimum of 10 minutes while stirring occasionally. Add approximately one drop each of red and yellow food coloring per 800ml to achieve desired flesh color. Using heat protective gloves or oven mitts, pour gelatin into the cup to cover both the balloon and cotton. Refrigerate for a minimum of two hours to fully set.

e.) Using red paint or moulage makeup, paint an asymmetric soft palate and deviated uvula on top of the gelatin, appropriately corresponding to the location of the balloon (Figure 1b).

4. Model completion. Insert the craft stick from the PTA cup into the slit at the base of the tongue of the airway head. This stabilizes and correctly orients the cup during needle aspiration. Additionally, the facilitator is made aware of the PTA location, as indicated by the marking previously made on the underside of the cup (Figure 1c).

*Exact measurements and positioning are specific to the headskin used and are determined by trial and error.

Approximately three hours were invested to build three task trainers, and an additional five hours were required to make 50 PTA cups.

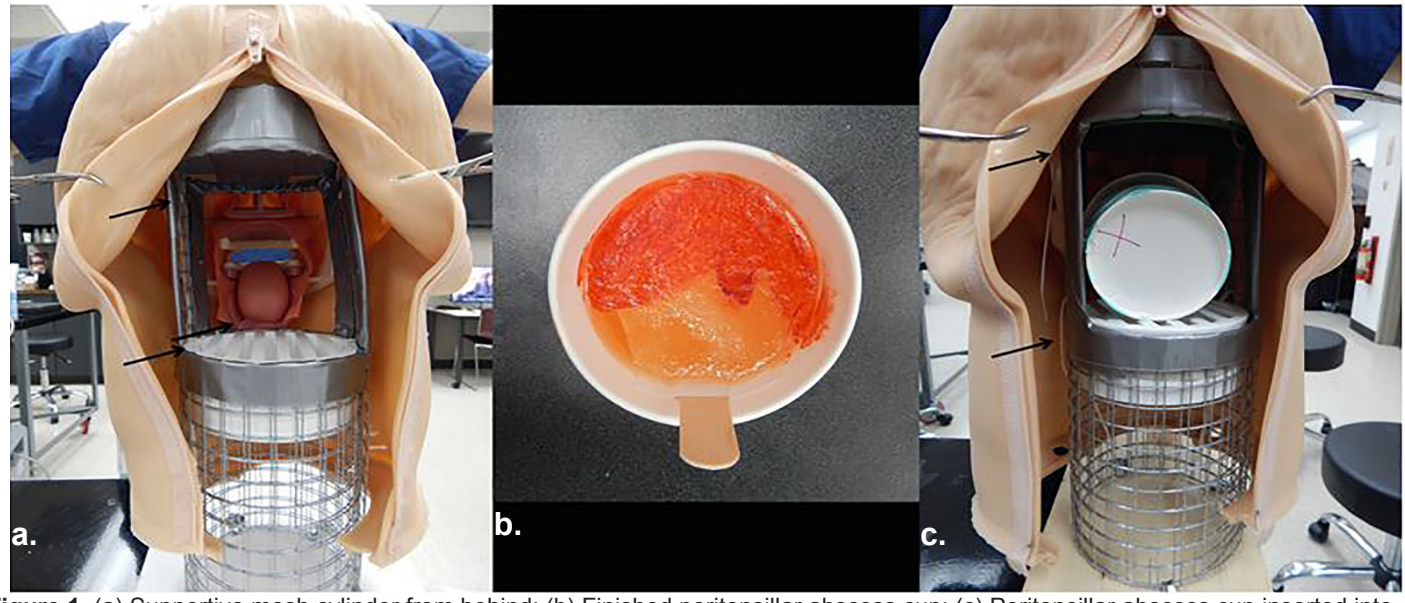

Figure 1. (a) Supportive mesh cylinder from behind; (b) Finished peritonsillar abscess cup; (c) Peritonsillar abscess cup inserted into task trainer.

IMPACT/EFFECTIVENESS

After a didactic session reviewing peritonsillar abscess presentation, treatment, and management, 46 EM residents performed PTA needle aspirations using the task trainers. Due to the airway headskin's plastic material, naturally occurring trismus realistically simulated the difficulty in performing ultrasound-guided aspiration. Faculty instructors provided direct feedback on ultrasound technique and procedural skills.

Residents were anonymously surveyed on their comfort performing PTA needle aspiration before and after the simulation session and were asked to rate ultrasound image realism, task trainer realism, and trainer ease of use on a five-point visual analog scale (VAS), with five being very realistic and easy. Sixteen of 46 (35%) residents completed the survey. Eleven had previously drained 1-3 PTAs in clinical practice, with the remaining five having no prior experience. On the VAS, residents rated their comfort with the PTA drainage procedure as 2.07 before and 3.64 after practicing the procedure on the trainer. Residents found that ultrasound images were representative of real PTAs (mean 3.41, range 2.4-4.7). They also reported that the task trainer was realistic (mean 3.73, range 2.5-4.8) and easy to use (mean 4.08, range 1.0-5.0).

Our model, based upon that of Bunting et al., has several advantages over previous trainers including the incorporation of pork gelatin/hydrolysate to facilitate realistic ultrasound image acquisition with a fair and differentiable interface between the abscess and oropharynx (Figure 2) and improvements to the headskin infrastructure with the addition of a sturdy mesh cylinder and plywood base, allowing it to be mounted securely to any table. The improved stability allows the model to tolerate significant manipulation during the simulated procedure, including the forces applied to overcome trismus and used with an intraoral ultrasound probe while acquiring images of the abscess. The abscess itself is also compressible, and needle visibility and echogenicity are similar to that in real practice. Despite the time required to create this infrastructure, costs remain low; and once built, the task trainer can be adapted for different otolaryngologic procedures such as epistaxis management, tongue laceration repair, and post-tonsillectomy bleeding management. PTA cups can be made on demand for any learner group size.

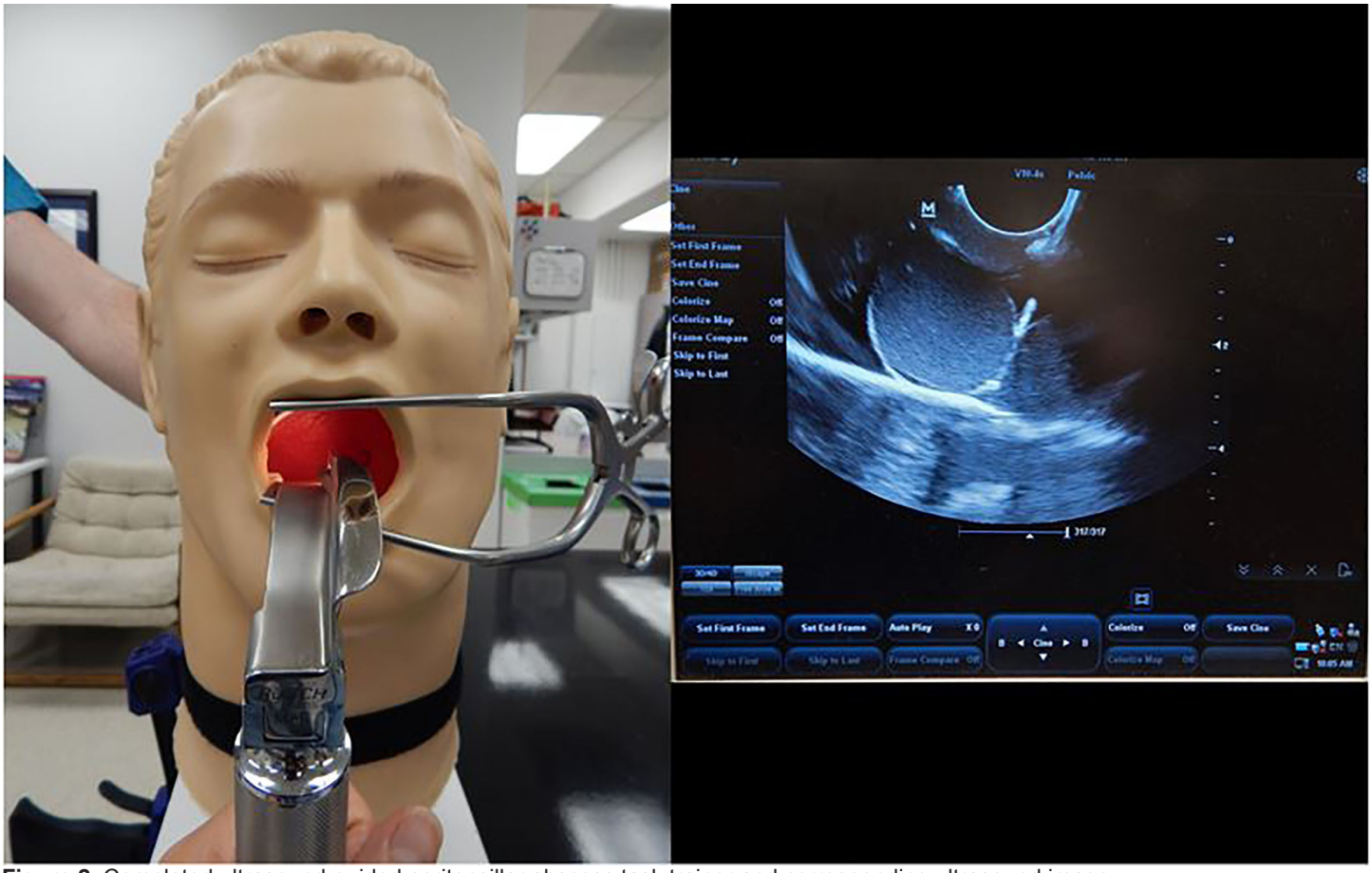

Figure 2. Completed ultrasound-guided peritonsillar abscess task trainer and corresponding ultrasound image.

LIMITATIONS

Our innovation has several limitations. The primary capital cost to construct the task trainer and abscess cups is time and experience. Physicians and non-healthcare providers built our trainers. Thus, it would be reasonable to suggest that any simulation technology specialist with at least one year of experience has the skills to build the model. If no discarded headskin is available, a new one costs upwards of $1,000. Our model used a Laerdal© headskin. While any discarded headskin should be adaptable to this trainer, others were not tested. Acquired ultrasound images are rudimentary and limited in their anatomic fidelity due to lack of adjacent tonsillar tissue and carotid artery, difficulty simulating abscess heterogeneity including septations and locations, and presence of needle tracks with multiple attempts. Additionally, cup edges are hyperechoic and may detract from the fidelity of the soft-tissue image.

Given the rudimentary images, validity evidence of the trainer's ability to teach accurate PTA diagnosis was not pursued. With regard to simulation implementation, the number of learners that can be trained and assessed is dependent on the number of simultaneously available task trainers and facilitators. Our survey response rate was low and limited by resident willingness to complete, thus prohibiting any meaningful statistical analysis. Furthermore, we surveyed novice learners on subjective constructs, a third of whom had never performed a PTA aspiration. This limits the impact and generalizability of their responses and our findings of improved procedural comfort, which is to be expected after a simulation experience. Finally, we did not pursue independent validation of the task trainer for the needle aspiration procedure, as our model was based upon that of Bunting et al, who validated their trainer with senior resident and attending otolaryngologists for both needle aspiration and incision-and-drainage techniques.[6]

CONCLUSION

In summary, we developed a low-cost, do-it-yourself, and easy-to-construct simulator that allows for ultrasound image acquisition while performing peritonsillar abscess needle aspirations. Our trainees found the ultrasound images realistic and had increased understanding of and comfort with needle aspiration management after practicing on the model. To the best of our knowledge, we report the first ultrasound-guided peritonsillar abscess model for simulation training. Educators from EM and otolaryngology can use this model to educate inexperienced trainees, thus ultimately improving patient safety in the clinical setting. Future work on the trainer should focus on improving ultrasound image fidelity to include diagnostic characteristics felt important by the ultrasound community.

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Anything but Shadowing! Early Clinical Reasoning in Emergency Department Improves Clinical Skills

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Introduction: Transitioning from the pre-clinical environment to clerkships poses a challenge to students and educators alike. Students along with faculty developed the Clinical Reasoning Elective (CRE) to provide pre-clinical students exposure to patients in the emergency department and the opportunity to build illness scripts and practice clinical skills with longitudinal mentorship in a low-stakes environment before entering clerkships. It is a voluntary program. Each year, the CRE has received overwhelming positive feedback from students. The objective of this study is to determine if the CRE improved students' clinical skills and reported comfort in their skills.

Methods: We examined the relationships between students' self-reported participation in the CRE and their individual scores on a comprehensive clinical assessment (CCA) at the end of the pre-clerkship period. A total of 178 students took the CCA exam in 2016. Of these, 113 participated in the CRE and 65 did not. Seven students who participated in CRE did not complete the exit survey and were omitted from analysis. We performed regression analysis and dichotomous (participants/nonparticipants) comparisons of means with t-tests. Survey of student reactions was collected.

Results: Participants completed an average of 10 sessions over the course of the program (range=1-20). Involvement in the CRE was associated with significantly increased scores on Abdominal History; Pulmonary Physical Exam; Overall History-Taking; Overall Communication; and Overall Physical Exam ($p<0.05$). Nearly all students (97%) reported that the program offered opportunities to enhance clinical skills, increased their comfort with patients, and better prepared them for their clinical years.

Conclusion: There were measurable improvements in clinical skills performance for students who participated in CRE. As many schools seek to incorporate early clinical exposure to their curricula, this program provides a successful framework to provide meaningful clinical exposure to real patients that also shows objective benefits to students' clinical skills. [West J Emerg Med. 2018;19(1)177-184.]

INTRODUCTION

One of the great challenges in medical education is the ability to transition the pre-clinical learner into a clinician who is able to readily recognize, diagnose, and treat patients. Studies suggest that students can find this period stressful.[1,2] In particular, students find it challenging to apply their knowledge in a practice setting and report anxiety about being evaluated on unfamiliar skills such as history-taking, performing physical examinations, proficiency in oral case presentations, and generation of differential diagnoses.[3–5]

The Clinical Reasoning Elective (CRE) is a student-led program designed to provide pre-clinical students exposure to patients and the opportunity to practice building differential diagnoses. The program has been a supplement to the curriculum of a U.S. medical school for the last five years, where students traditionally complete 18 months of didactic learning followed by two years of clinical experience. In this period students have a longitudinal clinical skills course that primarily uses standardized patients.

The program was designed to provide stepwise exposure to the clinical environment distinct from shadowing, in order to foster student development of self-directed learning.[6,7] With this goal in mind, the elective serves as a unique opportunity for students to practice formalizing the integration of data gathering from the history and physical, synthesizing these findings into assessments, and generating plans. Students are able to practice and develop these essential clinical skills without the performance pressure or formal grading that occurs during traditional clinical clerkships. These aspects have made the program incredibly popular among students, as it is one of the first opportunities for pre-clinical students to have meaningful experiences interacting with patients on the wards and get their first taste of clinical medicine.

In the 2015-2016 academic year, 113 (of 178) second-year pre-clerkship students were matched in pairs with 55 physician-mentors in the emergency department (ED) or an inpatient setting. Students completed histories and physical examinations on patients who presented with clinical problems related to the organ systems they were currently studying in the pre-clerkship curriculum, with an emphasis on independent learning and developing illness scripts.[8–11]

Students were expected to evaluate patients as a pair (without faculty present), formulate a differential diagnosis, and present the findings to their faculty member. Faculty provided feedback on their history, exam, presentation, and differential diagnosis. Students were encouraged to complete a minimum of two four-hour sessions with their faculty each month; however, there was no penalty for students who completed fewer sessions. Shifts were completed during normally scheduled faculty shifts, with preference for shifts where there were not other learners paired with the faculty member. Faculty were not provided additional compensation; however, evaluations were provided to each faculty member to be used for promotion. Student pairs were partnered with the same faculty member for the duration of the program to foster a longitudinal relationship with increased clinical independence as the year progressed.

Since its inception, the CRE has received overwhelmingly positive feedback in post-experience surveys from students; however, little is known about the objective benefit of the program with respect to students' clinical proficiency. The objective of this study was to determine if CRE improved students' clinical skills and reported comfort in their skills compared to those who do not participate.

METHODS

Participants

A total of 178 students completed the Comprehensive Clinical Assessment (M2 CCA) exam in 2016. Of these, 113 participated in the CRE and 65 did not. Student participation over the course of the eight-month program was self-reported through an exit survey (106 out of 113 students responded to the exit survey; 94% overall response rate and 82-94% item-level response rate). Seven students who participated in CRE did not complete the exit surveys and were omitted from analysis since we could not determine their participation in CRE. Thus, the total number of students was 171. Students completed shifts at the following locations: Adult ED (59%); Pediatric ED (22%); Emergency Critical Care / Short Stay Unit (17%); VA ED (10%); Other Inpatient Setting (6%), usually but not always at the same location.

Subjective Outcomes

Students completed an exit survey to provide feedback on the program including the following: 1) how many shifts they completed; 2) description of activities completed during their shifts; 3) contribution of these activities to their learning; and 4) interest in emergency medicine as a future specialty (Appendix A). The survey was designed by students (content validity evidence) and reviewed by the students as well as faculty supervisor of the program (content and response process validity evidence).[12]

Objective Outcomes

To objectively measure the influence of participation in the CRE on students' clinical skills, self-reported participation in the CRE was compared with students' individual scores on the M2 CCA. We obtained institutional review board approval for this study.

The M2 CCA takes place at the end of the pre-clinical curriculum and uses standardized patient cases to assess student performance on 12 domains including the following:

1. Abdominal, Cardiac, Pulmonary, Neurology, and Musculoskeletal Physical Exam Skills
2. Abdominal and Cardiac History-taking
3. Overall Measures for Physical Exam, History-taking,

Verbal Presentation, Note-writing, and Communication

The M2 CCA exam is formatted similar to the USMLE Step 2 Clinical Skills Exam, with each patient station requiring 2-3 tasks for the student to complete in an allotted time frame. The student receives the patient's age, vital signs, and chief complaint before entering the exam room. Station tasks may include taking a history, performing a focused physical exam, writing a patient encounter note, or giving a verbal presentation to a faculty member.[13] Students are scored with standardized rubrics by faculty and standardized patients.

Validity Evidence

Content validity evidence for the CCA2 is based on the faculty development committee providing expert judgment for content. Response process validity evidence is provided by a plan-do-check-ask process for improvement of the cases each year[14] reliability and equivalence of two parallel examinations that have been developed under highly defined quality assurance (QA The CCA2 results are examined and the cases adjusted to improve response process validity. In addition, the standardized patient (SP) communication scoring has significant training and inter-rater reliability testing using a kappa statistic. To quality control the SP scoring the program routinely runs kappa between raters and retrains raters scoring differently. The majority of the kappa values were > 0.6. Relationship to other variables is provided with this study (Appendix B). Finally, scores below the passing standard are independently re-scored for confirmation. If the failure is confirmed, the student must undergo remediation and re-take any failed components of the CCA. Successful completion of the M2 CCA is required for advancement to the clinical clerkships.

Analysis

We studied the relationship between students' scores on individual components of the CCA and the number of times they participated in the CRE. CRE participation was statistically significantly correlated with scores on five of the domains, and for these domains we conducted analyses with CRE participation treated as a continuous variable and as a binary variable. First, the influence of participation in the CRE with students' scores was examined with participation as a continuous measure (dose-dependent variable) based on the number of sessions each student attended using bivariate regression analysis. We then dichotomized the CRE participation variable (participant in CRE vs. non-participant) and used independent samples t-tests to examine group differences on CCA scores. The demographics of students participating and not were compared. In addition, the regression analysis included gender, age and race as covariates to test the effects of demographics on the results. An alpha level of 0.05 was used for all analyses. Student responses to the exit survey are reported as descriptive statistics. The IRB approved the study.

RESULTS

In our sample, the mean age was 27 years (*SD* = 2.6), and 54% were female. The breakdown by race/ethnicity was 6% African American, 24% Asian, 6% Hispanic, and 64% White. We examined associations between the demographic variables and participation in the CRE. Results showed that those who participated in the CRE were not statistically different in age, race/ethnicity and gender.

Students who participated in the CRE completed an average of 10 shifts with their mentors (12% of students completed 1-5 shifts; 50% of students completed 6-10 shifts; 22% completed 11-15 shifts; and 16% completed 16-20 shifts).

We conducted five separate bivariate regression analyses with the M2 CCA domain scores regressed on the number of CRE shifts a student completed. The unstandardized regression coefficients for five domains were statistically significant and provide insight into the range of impact that CRE can have on a student's scores (Table). The table notes the effect as well on the student's score for each CRE shift.

Table. Impact of student participation in the Clinical Reasoning Elective on M2 CCA domain scores.

	Mean score for all students	Standard deviation	Increase in Score for Every CRE Shift Completed[1,2]	Average Increase in Score with Participation in CRE[3]
Abdominal history	91.4%	7.85%	0.295%**	3.24%**
Overall history-taking	90.0%	6.19%	0.212%**	2.68%**
Pulmonary physical exam	94.7%	7.88%	0.218%*	3.47%**
Overall communication	87.8%	5.61%	0.147%*	0.21%
Overall physical exam	95.3%	3.39%	0.088%*	1.36%*

M2 CCA, second-year comprehensive clinical assessment; *CRE*, clinical reasoning elective.

1. All other domains were nonsignificant.

2. Unstandardized regression coefficients: p<.05*; p<.01**

3. Dichotomous participation; two-tailed t-test: p<.05; p<.01** This is the difference in average score for dichotomized participation. For example, those that participated had a 3.24% higher average score on abdominal history than those who did not.

For example, for the Abdominal History component of the exam each completed CRE shift was associated with an increase of about a third of a point in a student's scores. The mean scores between participants and non-participants on four of the domains of the M2 CCA were statistically significant (Table).

Student activities during a typical CRE shift were elicited as part of an exit survey. Follow-up questions collected students' opinions on how much each of those activities contributed to their learning (Figure 1). A majority of students completed patient histories and performed physical exams without faculty present and found these experiences to be highly beneficial. Students appreciated the opportunity to have real-world application and experience with conditions covered in the didactic pre-clinical curriculum. Self-reported perceived educational value of the CRE is shown in Figure 2.

One hundred percent of respondents reported that the elective increased their comfort with interacting with patients, asking questions, and interacting with attending physicians. Almost all participants (95%) reported that the CRE helped them build differential diagnoses for common chief complaints, with over half believing that this experience contributed "a great deal." In addition, 72% of student participants rated their learning experience with their mentor as "excellent," while 22% rated it as "Good."

Representative narrative students' comments demonstrate the overall positive student experience:

Student #1: *"CRE was the highlight of my preclinical education because it both reminded me of what was to come down the pipeline (i.e. practicing clinical medicine) and provided me with a much more interactive, engaging environment to learn clinical reasoning, history taking, and communication skills."*

Student #2: "*This was my first "independent" experience being in the hospital and seeing patients. We were pushed past our comfort zone and expected to present on all our patients. Even though we were beginners we were treated like colleagues and with the utmost respect. It was a safe yet challenging environment to learn medicine and prepare for our M3 careers."*

Student #3: "*The experience [my attending] provided in clinic serves as the framework for almost everything I learn in medical school. As the first attending to help me develop the thought process required for patient management, this contribution to my learning was invaluable."*

Student #4: "*While this may sound absurd, I was nervous to touch patients during the first few days, especially if the patients were in pain. I now appreciate how important it is to do a complete physical examination, even if the patient is uncomfortable, and have the confidence to actually perform the exam."*

A secondary outcome from participation in the CRE was increased student interest in EM as a specialty (Figure 3). Before taking the CRE, 26% of students were "very

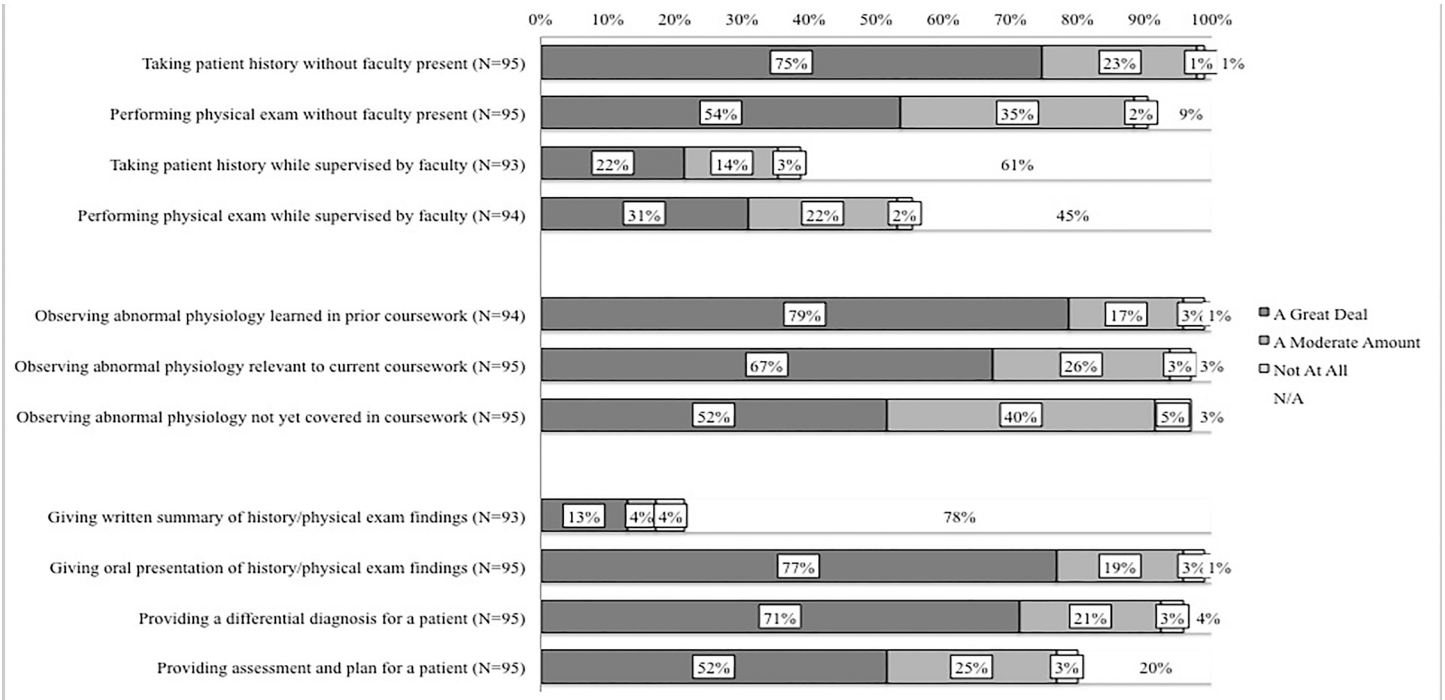

Figure 1. Student exit survey responses: "Of the activities that you completed during your shifts, how much did each of the following contribute to your learning?"

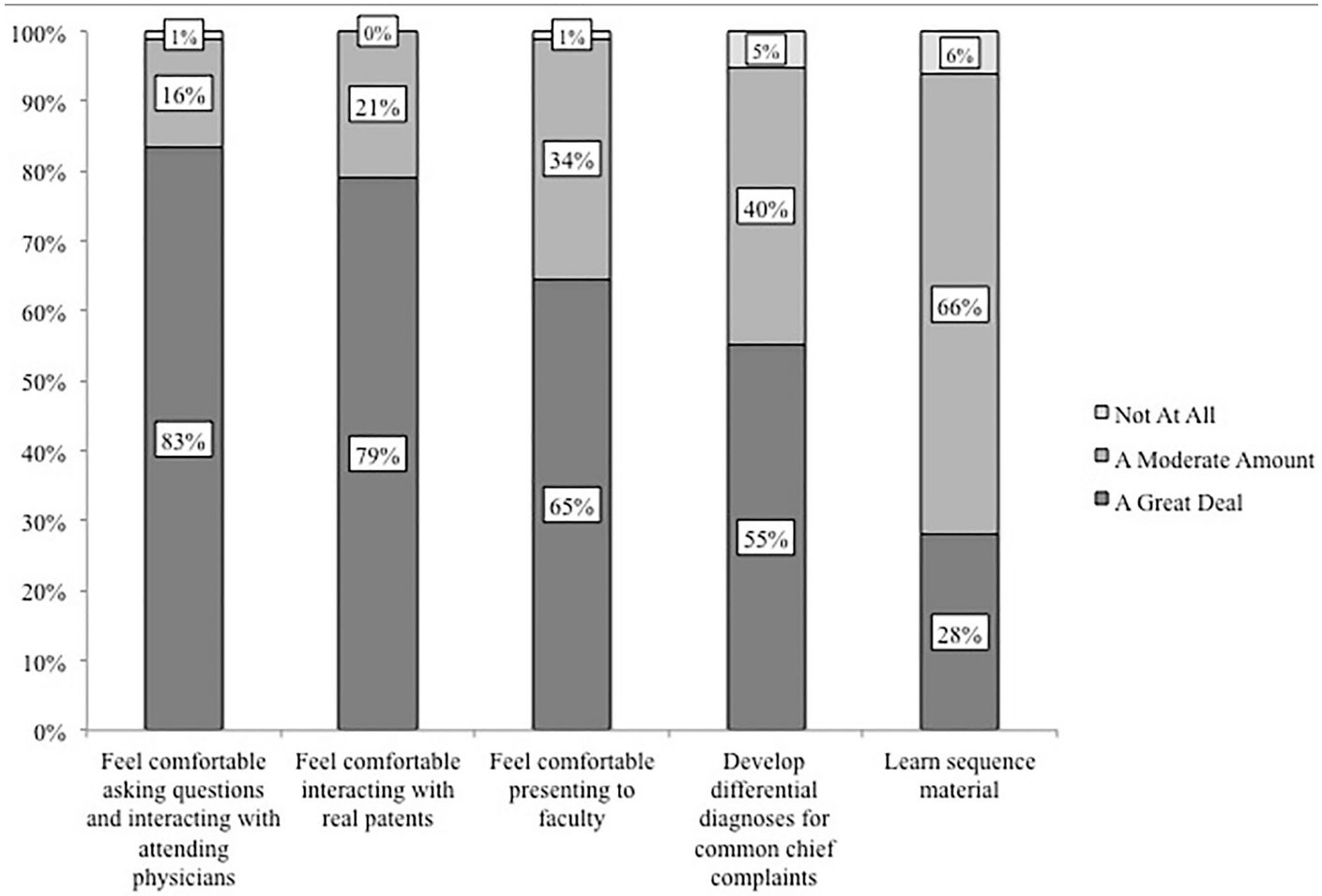

Figure 2. Student exit survey responses: "To what extent did the CRE help you..." (N=96).

interested" in EM or considered it to be their "top choice." However, after the completion of the elective, 46% of students reported that they were "very interested" in EM or considered it to be their "top choice."

Participants were asked about their interest in EM before and after the CRE, and for both questions the response scale was 1 = My top choice, 2 = Very interested, 3 = Somewhat interested, and 4 = Not at all interested, i.e., lower scores indicated greater interest. Results from a within-subjects t-test showed that interest in EM showed a statistically significant increase from before (M = 2.9) to after (M = 2.6) the CRE, $t(94) = 4.5$, $p < .001$, with a small-to-medium effect size, Cohen's $d = 0.46$.

DISCUSSION

Participation in a CRE for medical students significantly improved student scores on the end of pre-clerkship clinical skills examination in several domains. Furthermore, students' survey responses demonstrated that they felt more comfortable with their overall clinical skills and knowledge.

Notably, the value attributed to CRE activities by students suggests that participants gained learning experiences and early clinical exposure that are unattainable elsewhere in the standard pre-clerkship curriculum. Figure 1 highlights the value that novice learners place on the non-shadowing structure of the program that allows them to see patients on their own.

Within the ED, students are exposed to a variety of abnormal physical findings and prototypical chief complaints, which may aid in retention of clinical decision-making algorithms.[15–19] Pairing the chief complaints of patients with students' current systems of study may show even greater benefit in helping students integrate their knowledge networks.[20] Indeed, the ED may be ideally suited for transitioning pre-clerkship learners due to the opportunity to work through undifferentiated patients in a shift-based environment with a consistent mentor.[21–23] Allowing students to practice presenting to an attending faculty member in a clinical but non-graded environment allows students to gain confidence while developing familiarity with the clinical care environment.[5,24,25]

Of note, students showed substantially increased interest in EM as a potential specialty after completing the CRE. In contrast, a study in 2015 by Lambda et al. showed that a mandatory senior EM clerkship did not significantly change

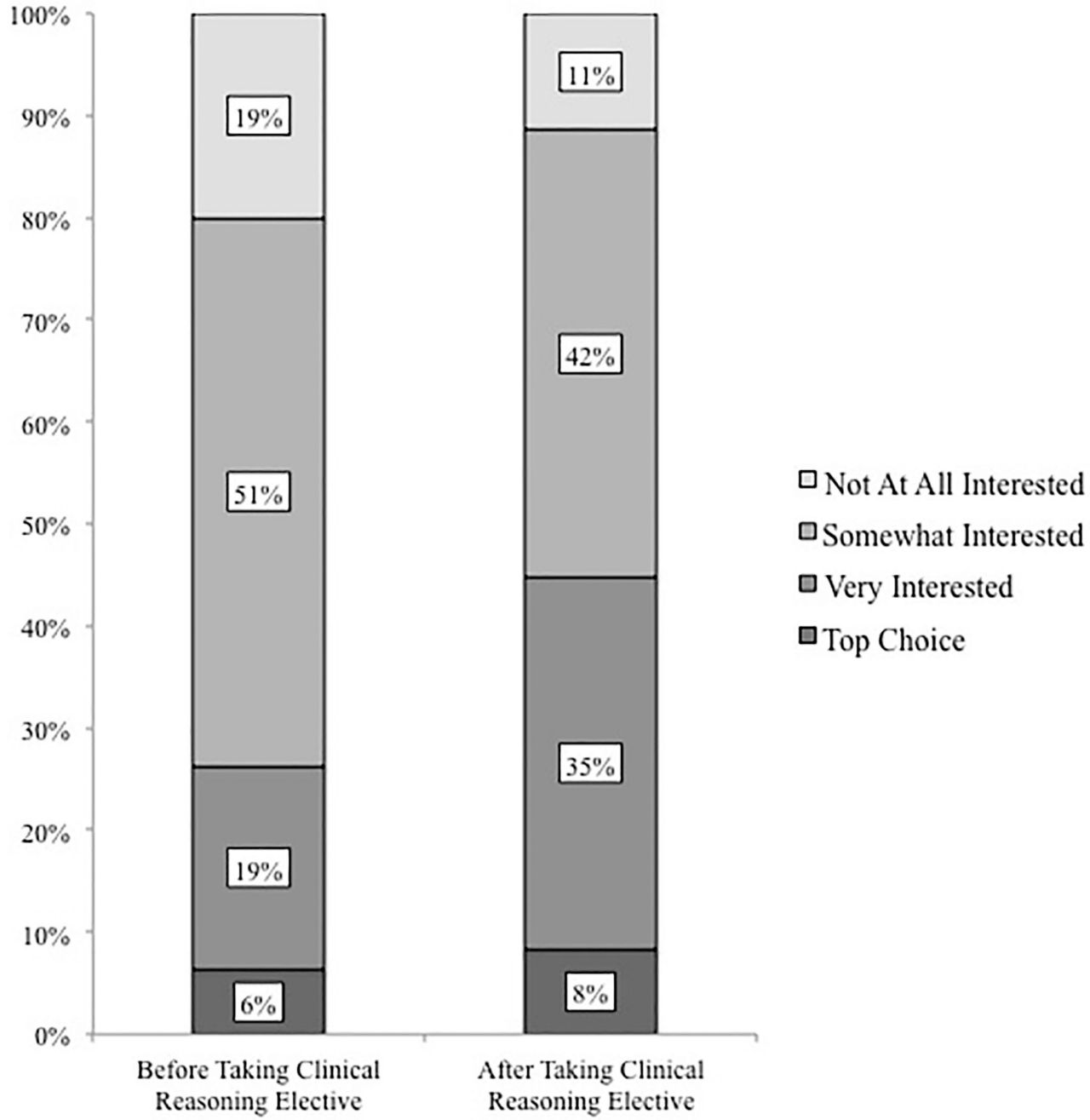

Figure 3. Student interest in emergency medicine before and after participation in the clinical reasoning elective.

overall students' perceptions regarding EM.[26] Based on our findings, early exposure to the ED may be more effective at cultivating interest in EM compared to clerkships later in training.

The CRE was born out of a desire to expose pre-clerkship learners to real patients while developing clinical reasoning skills and establishing the groundwork for forthcoming clinical clerkships. What started as a student-run elective, has served as a framework for the medical school to introduce students to the clinical setting early in their medical education as part of a curricular revision.

LIMITATIONS

There are several limitations to this study. First, it is unknown if the students who chose not to participate in CRE were different from the CRE participants. Students who are motivated to participate may also be more motivated to study and perform on the CCA. Therefore, it is uncertain whether variables outside participation in the CRE contributed to differences in exam scores.

While both students and physician mentors were provided with the goals and expectations for participation

in the program, freedom was given to the faculty to evolve the activities and responsibilities of students as the year progressed. We expect there was variation in the degree of autonomy granted to students, as well as the extent and quality of teaching provided between faculty. Additionally, due to the high volume of students who wished to participate in the CRE, a small number of students were assigned a physician-mentor outside of EM, but their objectives and expectations for the program remained the same as for the rest of the students. An additional limitation may be the self-reported nature of CRE participation. As this course was an ungraded elective, the authors hope that the number of sessions reported by students is accurate; however, this cannot be confirmed.

The M2 CCA and exit survey are an internally developed assessment that has some validity evidence collected, but there are gaps in the collected validity evidence. This is a single institution study, and generalizability of the results is not yet known. Finally, the high ceiling and narrow range of scores may not have allowed us to detect differences between the comparison groups.

CONCLUSION

Participation in a Clinical Reasoning Elective was associated with increases in students' scores on a comprehensive clinical assessment at the end of the second year of medical school. Higher examination scores may translate to greater preparedness and decreased stress as these students enter clinical clerkships. In addition, early exposure to the ED, along with longitudinal mentoring by emergency physicians, was associated with greater student interest in EM as a specialty. The framework of the CRE is an effective and popular model to teach history-taking, physical exam, and differential diagnosis skills while transitioning pre-clinical learners to the independent and hands-on learning environment of the clerkships.

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Interprofessional Emergency Training Leads to Changes in the Workplace

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Introduction: Preventable mistakes occur frequently and can lead to patient harm and death. The emergency department (ED) is notoriously prone to such errors, and evidence suggests that improving teamwork is a key aspect to reduce the rate of error in acute care settings. Only a few strategies are in place to train team skills and communication in interprofessional situations. Our goal was to conceptualize, implement, and evaluate a training module for students of three professions involved in emergency care. The objective was to sensitize participants to barriers for their team skills and communication across professional borders.

Methods: We developed a longitudinal simulation-enhanced training format for interprofessional teams, consisting of final-year medical students, advanced trainees of emergency nursing and student paramedics. The training format consisted of several one-day training modules, which took place twice in 2016 and 2017. Each training module started with an introduction to share one's roles, professional self-concepts, common misconceptions, and communication barriers. Next, we conducted different simulated cases. Each case consisted of a prehospital section (for paramedics and medical students), a handover (everyone), and an ED section (medical students and emergency nurses). After each training module, we assessed participants' "Commitment to Change." In this questionnaire, students were anonymously asked to state up to three changes that they wished to implement as a result of the course, as well as the strength of their commitment to these changes.

Results: In total, 64 of 80 participants (80.0%) made at least one commitment to change after participating in the training modules. The total of 123 commitments was evenly distributed over four emerging categories: *communication*, *behavior*, *knowledge* and *attitude*. Roughly one third of behavior- and attitude-related commitments were directly related to interprofessional topics (e.g., "acknowledge other professions' work"), and these were equally distributed among professions. At the two-month follow-up, 32 participants (50%) provided written feedback on their original commitments: 57 of 62 (91.9%) commitments were at least partly realized at the follow-up, and only five (8.1%) commitments lacked realization entirely.

Conclusion: A structured simulation-enhanced intervention was successful in promoting change to the practice of emergency care, while training teamwork and communication skills jointly. [West J Emerg Med. 2018;19(1)185-192].

BACKGROUND

Medical error has received considerable attention since the Institute of Medicine estimated that, in the United States alone, as many as 98,000 patients die annually from preventable medical mistakes.[1] While the exact numbers are disputed, and remain difficult to measure, more recent studies estimate the number of deaths attributable to medical errors to be around 250,000 per year in the U.S.[2] Emergency departments (ED) are notoriously prone to such errors[3,4], and evidence suggests that one key to decrease the rate of mistakes in acute care settings is to improve teamwork.[5]

Diagnostic accuracy can be increased through interaction in the ED,[6,7] and improved coordination within teams in intensive care is associated with decreased patient mortality.[8] Transfer of care situations, such as a handover from prehospital to hospital teams, are particularly susceptible to medical errors, due to communication failures and loss of information.[9] These factors, fortunately, seem to be amenable to training.[10] The World Health Organization specifically suggested improving interprofessional collaboration as an important way to reduce medical error.[11] The recent "Call to Action for Emergency Medicine" by Wilbur[12] highlights the importance of this collaboration, advocating for the implementation of interprofessional education and its evaluation in emergency medicine.

Education is interprofessional "when students from two or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes."[12] One central goal of such education is the improvement of team skills[13] and communication. Consequently, early educational interventions that improve communication within healthcare teams are likely to be beneficial to patients. Still, professionals who are meant to routinely collaborate with others in an interdisciplinary ED are trained and educated in separate "silos"[12] in many countries, rendering the development of shared mental models, a common language, or a clear conception of each other's roles virtually impossible.

OBJECTIVES

We aimed to conceptualize, implement, and evaluate a training module for final-year medical students, as well as advanced trainees from emergency nursing and student paramedics. The objective was to sensitize participants to professional barriers for their communication across borders, especially in the ED, as it represents an important interface between prehospital and ED teams. Our goal was to establish a mutual understanding of each other's roles, and of professional self-conceptions. We further aimed to enable participants to conduct basic emergency care for a critically ill patient as an independent interprofessional ad hoc team, with a special focus on communication and team interaction.

CURRICULAR DESIGN

Conception

Due to the above-described lack of interprofessional training, we developed a longitudinal, simulation-based training format for three professions based on Kern's *six-step approach*[14] (problem identification, needs assessment, formulation of objectives, developing formats, implementation, and evaluation). An interprofessional team consisting of medical, nursing, and paramedic educators planned the educational activity. The resulting training consists of several one-day training modules. We conducted two modules as a pilot. Each module has the same overall structure of an introduction followed by simulated scenarios. The scenarios differ between modules. We invited the same population of student paramedics and emergency nursing trainees, who are both organized in classes. For both groups, the two modules were made a part of their schedule. As a result, most of the student paramedics and emergency nursing trainees participated in both pilot modules and will participate in the following one as a longitudinal course.

Such a longitudinal integration was not possible for medical students, because the training modules were not compulsory and not planned as a longitudinal format, due to difficulties in acquiring a series of time slots in their busy academic schedule. As a result, different medical students participated in the first and second training module. However, this also provided a greater number of medical students the opportunity to attend a training module at least once and relates to real-world circumstances, where teams often form ad hoc without prior acquaintance.[15]

Our long-term objective is to implement this longitudinal format into the new curricula for emergency nursing and paramedics trainees, as well as to offer the format as a voluntary course for medical students. As we have extensive experience with the team-training format in the ED setting,[17,18] we decided to use simulation-enhanced interprofessional education as our educational strategy, due to its well-known positive effects on attitudes towards teamwork and communication.[19,20]

Implementation

After providing oral and written informed consent at the beginning of every module, participants were randomly assigned into four groups, equally staffed with the three professions. Each team met for an introduction session in the morning. The purpose of this first interprofessional meeting was to get acquainted with each other, to discuss each member's roles, professional self-concepts, common misconceptions, and communication barriers. Every module had a "Topic of the Day", such as "handover," "Manchester Triage System," or "Crisis Resource Management," which was introduced by an impulse presentation. Furthermore, the interprofessional team of instructors asked for expectations and personal goals for each day.

After introduction, every team rotated through different simulated emergency cases throughout the day. Cases were selected by the interprofessional team of instructors, reflected common emergencies, and contained challenges for interprofessional collaboration, such as team communication and interaction. Every case used high-fidelity simulators or simulated patients. Examples of cases used in the first training module are depicted in Table 1. Each case consists of a prehospital section (for paramedics and medical students), a handover (everyone), and an ED section (medical students and emergency nurses).

After every case, all students underwent extensive structured debriefing by an interprofessional team of instructors, which consisted of members of at least two professions, as well as one expert in communication. Debriefing structure followed the common three-step GAS-model[21], and is composed of the following parts:
a) Gather information from participants ("*How do you feel after this case?*")
b) Analyze information with further questions ("*What went well?;*" "*What happened during handover?;*" "*Do you see any chance for improvement?*") and directive feedback
c) Summarize debriefing with learning goals for the next simulation by the instructor team. Debriefing focuses especially on the "Topic of the Day."

Adaption to Participant Feedback

We implemented some changes in our concept after the first training module, based on oral and written feedback from the participants and group discussions among the instructors:

- The number of cases was decreased; simulation/debriefing-time was increased to 90 minutes, allowing for more debriefing time.
- Focus of cases was changed, and more time for paramedic treatment was given: transportation by ambulance was added, so as to balance treatment time between disciplines.
- Due to confusion during debriefing in the first event, roles during debriefing were specified: the medical and communication debriefings were divided between different instructors, so as to establish a more focused observation during simulation. We also allocated a time slot to allow for peer observers to give individual (one-on-one) feedback to their colleagues.

Table 1. Student interest in emergency medicine before and after participation in the clinical reasoning elective.

Case (Diagnosis)	Alert & patient presentation	Anticipated course of simulation	IPE Focus
Urinary tract infection and dehydration (SP)	Suspected stroke: geriatric patient with sudden onset of confusion	fast transport into hospital for diagnostics (P)→handover (P→EN/MS)→diagnostics (bloodworks, urine sample, cCT scan) organizing transfer to ICU (EN+MS)	Good handover needed according to high risk of information loss on a patient who can't give information himself.
Minor head injury (SP)	Bicycle accident: drunk and uncooperative patient with laceration on forehead and bruised right arm	Wound management, immobilization and transport (P)→ handover (P → EN/MS) → examination and decision on further diagnostics (EN+MS)	Developing a common concept of managing an uncooperative patient out of different strategies.
Hypoglycaemia and leg injury (Simulator)	Unclear coma: unconscious patient with leg injury is found by joggers in a park setting near a tree	Treatment hypoglycemia, wound and pain management, transport (P/MS) → handover (P/MS → EN/MS) → neurological examination, blood works, x-ray leg and prioritization of further treatment (EN/MS)	Gathering and transferring information of an unknown patient and an unclear course of events.
Acute coronary syndrome (Simulator)	Transfer transport I: Patient in the ER of a smaller hospital with STEMI to be transferred to the next hospital with cardiac catheter	Patient goes into cardiac arrest (Ventricular Fibrillation) during handover (EN/MS → P/MS) → immediate Advanced Life Support → ROSC after 3 shocks and first drug administration	Switching to resuscitation immediately especially in a situation of unclear leadership during hand over.
Esophageal variceal bleeding with hemorrhagic shock (Simulator)	Transfer transport II: Patient after liver transplantation to be transferred from ICU to a different hospital	planned transfer of a postoperative patient → patient spits blood and goes into hemorrhagic shock during handover (EN/MS → P/MS) → Managing circulatory problem (infusion/transfusion), securing airway and initiating further treatment	Managing an unforeseen situation in mixed teams.

IPE, Interprofessional Education; *SP*, simulated patient; *P*, paramedic student; *EN*, emergency nursing trainee; *MS*, last year medical student; *ER*, emergency room; *cCT*, cranial computer tomography; *ICU*, intensive care unit; *STEMI*, ST-elevation myocardial infarction; *ROSC*, return of spontaneous circulation.

More simulated patients were added, as feedback indicated that they were particularly challenging during scenarios. Furthermore, other challenges, such as pediatric emergencies, distractors, bystanders, and technical incidents, were added to the cases.

IMPACT / EFFECTIVENESS

Although the relationship between team performance and team culture has long been recognized in acute care,[22] establishing a link between team characteristics and patient outcome is notoriously difficult.[5,23] One reason for this is that the effect of any educational intervention is likely diluted by the many other factors influencing the transition from individual learning, to behavior within teams, team performance, and finally to patient care, which ultimately determines patient outcome.[5,24] Thus, Cook and West recommend chains of carefully designed studies linking educational interventions to learning effects, learning to behavioral change in the workplace, and behavioral changes to changes in patient care, finally influencing patient outcomes.[24] Many studies, however, fall short of assessing educational outcomes beyond participant satisfaction. [25,26] "Commitment to Change" (C2C) is one of the few tools that can be used to promote and assess behavioral changes induced by an educational intervention.[27–29] It has been extensively used in different areas, inside and outside healthcare, to stimulate and evaluate performance change.[27,29–35] C2C has been associated with behavioral change,[29,36,37] and is predictive of success in change initiatives.[34,38] In this C2C approach, participants are anonymously asked to state up to three changes they wish to implement as a result of a course, as well as the strength of their commitment to these changes. After a timespan that allows for implementation, participants are asked to report on their success, and reflect on factors that fostered or hindered implementation.

We translated the original English version of C2C[39] into German using the established TRAPD (translation, review, adjudication, pre-test, documentation) methodology.[40] The translated version is available as an appendix.

We collected C2C directly after training (t1), ensuring participant anonymity, while also enabling a follow-up survey after two months (t2). Specifically, we asked participants to generate a unique individual code by appending the first two letters of their mother's given name, the last two digits of their father's year of birth, and the first two letters of their place of birth (e.g. PE62BE for a mother named Petra, a father born in 1962, and Berlin as place of birth). For follow-up, we provided the participants with envelopes labeled with their code, containing a follow-up survey on their personal commitments to change. Medical students, who are more difficult to reach as they are not organized into classes, were invited via mail to participate in the follow-up survey. An incentive of 20€ was granted to every medical student participating in follow-up.

We analyzed commitments, together with basic demographic data, in a mixed method approach, both quantitatively and qualitatively. Basic demographic characteristics of our participants and attendance at follow-up are shown in Table 2.

Textual data, such as commitments, or responses regarding factors that fostered or hindered implementation of the intended changes, were inductively categorized by three researchers (DE, FS, and JG) according to Mayring.[41,42] All three researchers (two physicians and one senior medical student) discussed each commitment until full consensus was reached regarding which category was the most appropriate. Emerging categories were defined and adapted, regrouping statements until all commitments were assigned to as little categories as we deemed appropriate. After categorization, the results were presented to an independent psychologist, who was responsible for consistency check and content validation. The process of inductive categorization is often used with qualitative data. The indicators used to assess the quality of qualitative research are generally different from the quantitative methods commonly used in biomedicine, although the quality principles applied to both are similar.[43]

In total, 64 of 90 participants (71.1%) made at least one commitment to change after the training modules (18 trainees of emergency nursing, 22 student paramedics, 15 medical students, and 9 not assignable). That led to a total of 123 commitments made by our participants (see Table 3), which were divided into four broad areas. Commitments were evenly distributed over three emerging categories, namely *communication*, *behavior,* and *knowledge,* as well as a slightly less prominent fourth category, *attitude*. Roughly one third of behavior- and attitude-related commitments refer to interprofessional topics (e.g., "Acknowledge other professions' work"), and these were equally distributed among professions. Table 3 presents all categories and examples of commitments to change.

At the two months follow-up (t2), 32 participants (50%) provided written comments on their original commitments. At follow-up, 57 of the 62 (91.9%) commitments were reported to be at least partly realized, and only five (8.1%) commitments (still) lacked realization. The best rate of commitment realization was (self-) reported by trainees of emergency nursing, with 13 fully implemented commitments out of 31 (41.9%). We did not observe any significant correlations between the strength of commitments and the probability of their realization ($r=0.222$; $p=0.1$), suggesting that realization is more strongly influenced by external factors in the workplace than by participant motivation. This hypothesis is further supported by the qualitative analysis of factors that hinder implementation, namely "*not enough practice,"* "*not enough time,"* "*unsupportive colleagues," and "excessive demand."* Likewise, the most frequently mentioned factors fostering change were "*practice," "colleagues,"* and *"teachers."*

Table 2. Demographic characteristics of participants of first and second training module by professional and participation status (age measured in years).

	Emergency nursing			Paramedics			Medical students			Total*		
	Participated	Initial C2C	Follow-up	Participated	Initial C2C	Follow-up	Participated	Initial C2C	Follow-up	Participated	Initial C2C	Follow-up
1st Training model												
No. (% female)	15 (78.6)	10 (80.0)	7 (85.7)	20 (40. 0)	11 (45.5)	5 (40.0)	11 (36.4)	9 (33.3)	0 (-)	49 (46.9)	33 (48.5)	12 (66.7)
Mean age (SD)	33.53 (7.89)	31.50 (6.87)	32.43 (7.79)	21.79 (3.05)	21.82 (3.03)	20.40 (1.14)	27.82 (3.97)	27.22 (3.80)	- (-)	27.18 (7.32)	26.67 (6.23)	27.42 (8.48)
2nd Training model												
No. (% female)	11 (72.7)	8 (75.0)	7 (71.4)	14 (28.6)	11 (36.4)	8 (37.5)	7 (42.9)	6 (33.3)	1 (0.0)	41 (41.5)	31 (45.2)	20 (50.0)
Mean age (SD)	29.20 (4.19)	30.57 (4.32)	30.83 (4.67)	22.86 (3.48)	23.45 (3.73)	22.75 (3.69)	26.29 (1.98)	26.50 (2.07)	23.00 (-)	27.00 (6.84)	27.92 (7.33)	28.53 (8.94)

C2C, commitment to change; *SD*, standard deviation; *No.*, Number.
*Differences to preceding columns result from participants unassignable to their professional group.

Validity Argument

In this description of an educational intervention, we report on self-reported commitments to change and self-reported implementation rates. One apparent question that results from the nature of these data is,whether or not C2C is a valid measure of educational outcome for our training. In the following section, we will thus discuss the validity argument for the conclusions drawn from this study, guided by Messick's five sources of validity evidence as adapted to medical education by Cook et al[44] and Beckman.[45]

The C2C survey basically consisted of one item: "I commit to complete the following in the next 2 months:" with the option to make up to three statements of anticipated changes, together with a strength of one's commitment. For all its brevity, this approach has been taken successfully for many years in different contexts.[27,29–35] Purkis et al. were able to demonstrate that self-reported intentions of changing behavior were followed by actual behavior changes in physicians following a continuing medical education (CME) intervention.[29]

Content evidence: At present, the use of C2C has rarely been reported in an interprofessional setting. However, behavioral and attitudinal changes were emerging categories in our study and insufficient time was frequently cited as a barrier for realization, consistent with Evan's findings.[35] Because there was no possibility to directly measure and observe changes of our participants in their workplace, we chose the well-established method of C2C, which has been developed and validated for this very content.

As for the response process, we report that C2C was part of the evaluation at the end of every module. Statements made by participants were consistent, reflecting a good understanding of the question. All participants had protected time to complete the survey, with an instructor available for questions. We observed a slightly increased motivation to take part in the survey after the second module as some participants already knew the tool and had received their own statements of the first module as a reminder during follow-up. Furthermore, we investigated the possibility of a non-response bias as a possible consequence of the response process. (See below.)

Many participants committed to similar changes, which we were able to cluster into different categories as shown above. Since data from C2C do not allow for elaborate quantitative analyses, we regard this as the best possible internal structure evidence. Due to this relatively new approach in an interprofessional educational setting we, however, fail to provide relationship evidence.

However, regardless of the content of the commitments made or the ability to realize the anticipated changes, the first consequence of the C2C survey was that participants had to reflect on what they had just learned, helping them to identify areas of personal improvement. As a second consequence, at least some participants will try to actually put their committed changes into realization in their workplace (consequences evidence).

Table 3. Categorization of "commitment to change" statements from first and second training module.

Category	Examples of quotes	Emergency nursing (n=26)	Paramedic (n=34)	Medical students (n=18)	Not assignable (n=11)	Total
Knowledge	"revise cardiology", "revise ABCDE scheme", "consolidate basics"	6	7	12	5	30 (24.4%)
Communication	"greet the paramedic team", "clear and structured handover", "targeted communication", "attentive listening"	16	11	8	7	42 (34.3%)
Behavior/ teamwork	"appreciate other professions, get to know them personally", "10 seconds for 10 minutes principle"	7	7	9	1	24(19.5%)
Attitude/ others	"improve understanding for other professions", "appreciation", "respect", „become more confident", "reduce coffee consumption"	10	8	2	7	27 (22.0%)
Total		39 (31.7%)	33 (26.8%)	31 (25.2%)	20 (16.2%)	123

Nonresponse Bias Analysis

Due to the dropout of 50% between first assessment and follow-up, we conducted a nonresponse bias evaluation and tested for differences between the responder and non-responder group using exploratory statistics. Nonresponse bias is a bias resulting from one group of participants being systematically more likely to answer a survey than another;[46] e.g., participants who were successful in implementing their intended changes could be more willing to report on those successes than participants who could not realize these changes. There were no significant differences between groups in age ($p = 0.340$; independent samples t-test) and gender ($p = 0.294$; Fisher's exact test). However, trainees of emergency nursing (n=14; 77.8% response rate on follow-up) and student paramedics (n=13; 59.1%) were significantly more likely to respond than medical students (n=1; 6.7%; $p < 0.01$; Pearson's chi-squared test).

LIMITATIONS

Relying on self-reports only, our data are inherently limited. Also, although the C2C-approach employed in this study has been extensively used in continuous medical education, further research is warranted to strengthen the link between teaching events, C2C, and objective changes in the workplace. Furthermore, C2C is meant as a tool to enhance change in the workplace, and as such, from a theoretical perspective, its use as a measurement instrument is limited.

Another limitation is the 50% response rate in the follow-up survey, which may introduce nonresponse bias. There is only little reported use of the C2C approach in an interprofessional setting.[35] Compared to studies surveying students, that report response rates of 46%-31%,[47–50] a 50% response rate in our sample seems satisfactory. However, conclusions about medical students remain limited, despite an incentive, due to the high dropout rate. This effect could be related to poor availability, as the training modules are not part of medical students' mandatory curriculum, and students hardly participated more than once.

Lessons Learned and Future Directions

Planning an interprofessional simulation training requires considerable time, coordination, and resources. It is very rewarding to see that the effort has an effect beyond participant satisfaction. C2C is an easy-to-use tool to help students reflect on what lessons to take home – and into their work place. While lack of time is a frequently cited obstacle hindering change,[35,51] a lack of practical training, as well as unsupportive colleagues and teachers in the workplace, seem to be neglected as a factor preventing students from change. As practice is important, interprofessional simulation trainings and internships should be implemented as longitudinal programs in the respective curricula of all involved health professions.

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A Novel Approach to Medical Student Peer-assisted Learning Through Case-based Simulations

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Introduction: Peer-assisted learning (PAL) is the development of new knowledge and skills through active learning support from peers. Benefits of PAL include introduction of teaching skills for students, creation of a safe learning environment, and efficient use of faculty time. We present a novel approach to PAL in an emergency medicine (EM) clerkship curriculum using an inexpensive, tablet-based app for students to cooperatively present and perform low-fidelity, case-based simulations that promotes accountability for student learning, fosters teaching skills, and economizes faculty presence.

Methods: We developed five clinical cases in the style of EM oral boards. Fourth-year medical students were each assigned a unique case one week in advance. Students also received an instructional document and a video example detailing how to lead a case. During the 90-minute session, students were placed in small groups of 3-5 students and rotated between facilitating their assigned cases and participating as a team for the cases presented by their fellow students. Cases were supplemented with a half-mannequin that can be intubated, airway supplies, and a tablet-based app (SimMon, $22.99) to remotely display and update vital signs. One faculty member rotated among groups to provide additional assistance and clarification. Three EM faculty members iteratively developed a survey, based on the literature and pilot tested it with fourth-year medical students, to evaluate the course.

Results: 135 medical students completed the course and course evaluation survey. Learner satisfaction was high with an overall score of 4.6 on a 5-point Likert scale. In written comments, students reported that small groups with minimal faculty involvement provided a safe learning environment and a unique opportunity to lead a group of peers. They felt that PAL was more effective than traditional simulations for learning. Faculty reported that students remained engaged and required minimal oversight.

Conclusion: Unlike other simulations, our combination of brief, student-assisted cases using low-fidelity simulation provides a cost-, resource- and time-effective way to implement a medical student clerkship educational experience. [West J Emerg Med. 2018;19(1)193–197.]

BACKGROUND

Peer-assisted learning (PAL) is the development of new knowledge and skills through active learning support from peers. It specifically involves individuals who are peers, not professional teachers, and who are also learning themselves through teaching.[1,2] Furthermore, it is not simply a group activity or cooperative problem-solving in which peers are not directly teaching or assessing.[3] In short, it is medical students teaching medical students.

PAL is primarily founded upon the theories of social constructivism and cognitive congruence.[4,5] Social constructivism is characterized by the process of learning

in a group setting towards the development of shared meaning created by the collaborative interaction itself.[6] PAL is informed by this theory in that students learn from peers in a social setting towards a common goal of understanding.[5] The more commonly cited theory underpinning peer-assisted learning initiatives is cognitive congruence.[1,5,7] Cognitive congruence focuses on the relative gap in knowledge between a student and an instructor and states that the relatively smaller gap between student teachers and student learners allows for the enhancement of communication of facts and understanding.[8] Essentially, students are more apt to explain content in relatable ways to each other.

Beyond the theories that form the basis of PAL, PAL may be effective for a number of other reasons. Student learners are often more engaged in active learning and at ease to ask questions and clarify understanding with fellow students, while student teachers may deepen their understanding and improved retention in a topic they prepared for and delivered. Furthermore, an understanding of the learning process and the ability to teach is an important skill for competent resident physicians to possess, for teaching junior learners and for teaching patients about their conditions. PAL allows students to participate in teaching in a safe learning environment in anticipation of becoming teachers themselves when they graduate to residency.[9,5,10] Also, PAL inherently encourages students to take responsibility for their own learning and develop critical lifelong learning skills. From the educator's standpoint, faculty time is a limited resource that can be the rate-limiting step in providing interactive learning experiences for medical students. PAL offers an active learning education approach that is also an efficient use of faculty time.

Studies evaluating the effectiveness of PAL have demonstrated a positive effect on student teachers' performance, concluding that students are more likely to retain concepts they teach and that they often spend more time preparing for topics they are expected to teach.[11] In addition, research on the effect of student learners' performance has demonstrated that PAL increased improvement in objective structured clinical examination (OSCE) and test scores.[5] The instances in which PAL had no effect or negatively impacted performance in the literature were largely due to complex content beyond the skills of student teachers to deliver.[12]

There is a paucity of research on PAL in emergency medicine (EM). One recent article on the effective use of peer teaching for medical students demonstrated that students' response to peer teaching was positive and they learned equally well.[13] This example may under-represent the benefits of PAL, as they used high-fidelity simulations, which demand a higher preparation time and cognitive load for student learners. Additionally, implementation of high-fidelity PAL simulations may also be less feasible and less cost effective to replicate.

Given the many positive attributes of PAL, we present a novel PAL curriculum in an EM clerkship curriculum using an inexpensive, tablet-based application for students to cooperatively present and perform low-fidelity, case-based simulations.

OBJECTIVES

Our goal was to develop and implement a case-based PAL session that promotes accountability for student learning, fosters teaching skills, and economizes faculty presence.

CURRICULAR DESIGN

This innovation was a part of a required month-long EM clerkship for fourth-year medical students at two academic sites. Students in the clerkship are expected to learn primarily through direct patient experience and bedside teaching, supplemented with virtual lectures, directed readings, labs and simulation experiences. They are required to attend two lab days that involve clinical workshops and simulations. The first lab day is conducted during their first week of the clerkship and includes high-fidelity simulations focusing on Acute Cardiac Life Support cases. The second lab day is conducted during the second week of the clerkship and involves the innovative PAL cases.

We developed five clinical cases representing a range of acute conditions seen in EM in the style of EM oral boards (Table 1). We chose this style to provide a consistent and familiar case structure for faculty supervisors and to allow each student teacher preparing for their own case to become familiar with the structure of the cases that their fellow students would present. One week in advance of the session, students were assigned one of the five unique cases and were given a colored folder containing their case and a three-page document explaining the overall session and expectations. They also received a link to a 13-minute video tutorial on how to use the software they would be using to teach, and a video demonstrating an example case. Expected preparation time for students was less than one hour.

The learning objectives are outlined for the student teacher to review, and each case file starts with an overview of the patient's clinical course. The case starts in a typical oral boards format with the student teacher verbalizing the chief complaint, vital signs, and general appearance. The student teacher then responds to any questions or actions from the student learners in their group, and the student teacher acts as facilitator, nurse, and consultant as needed. There are prompts for the student teacher to help guide the student learners when the team should perform critical actions in each case. For example, in a patient with sepsis for whom the students are expected to order a lactate with labs, the case has the prompt: "If the team fails to get a lactate then ask, 'Doctor, you mentioned sepsis in your differential. Aren't there guidelines on what labs we need if we are suspecting sepsis?'" There are

Table 1. Clinical cases and key directed teaching points for peer-assisted learning cases in an emergency medicine clerkship

Clinical case	Key teaching points
Supraventricular tachycardia, 37-year-old female	• Review pathology and findings with Wolff-Parkinson-White (WPW) syndrome. • Review the ACLS algorithm for tachycardia
Subdural hemorrhage, 48-year-old male	• Briefly review the differential of altered mental status • Discuss the importance of maintaining a broad differential for patients with altered mental status.
Aortic dissection, 64-year-old female	• Review classification of aortic dissection. • Review initial treatment for aortic dissection. • Discuss components of an effective consult.
Ectopic pregnancy, 31-year-old female	• Review risk factors for ectopic pregnancy. • Consider obtaining a pregnancy test for every woman of reproductive age in the ED. • Review indications for Rho immune globulin (RhoGam).
Sepsis, 82-year-old female	• Review definitions of SIRS, sepsis, severe sepsis and septic shock. • Early recognition and treatment of patients with sepsis improves morbidity and mortality. • Obtain a lactate early. If the lactate is elevated, repeat lactate after fluid resuscitation.

ED, emergency department.

also prompts for timing, and for concluding the case by 10-12 minutes to give time to debrief and teach. At the conclusion of each case, there is a guide for the student teacher to conduct a debriefing with their group as well as to discuss some brief outlined learning points specific to the case.

An iPad-based (Apple Inc.©) application, SimMon (Castle+Andersen ApS ©, $22.99), served as a low-fidelity, simulated monitor. The student teacher had access to one iPad, which served as the remote, and it was linked via Bluetooth® to a second iPad serving as the display monitor for the student participants. Each student watched a video tutorial on how to use the application. One device pairs with the other; one serves as the remote while the other as the display. Manipulable variables include heart rate, cardiac rhythm, respiratory rate, oxygen saturation and blood pressure. They are changed simply by moving one's finger up or down on the remote control screen. There is also a timer to help students track time for their case. Each student watched a short video tutorial demonstrating an example of how to lead a case while using the application.

Each PAL session lasted 90 minutes. Students were placed in small groups of 4-5 students sorted into groups by the same folder color that contained their teaching case to ensure that each group would have a collection of unique cases. Students rotated between facilitating their assigned cases and participating as a team for the cases presented by their fellow students. Cases were supplemented with a half-mannequin that could be intubated, airway supplies and the tablet-based application described above to remotely display and update vital signs. One faculty member rotated among two or three groups to provide additional assistance and clarification. The faculty member also received a facilitator guide to outline the session objectives, and was directed to allow students to primarily guide the teaching session so as not to undermine the actualization and benefits of PAL while still proving content expertise and ensuring educational quality.

As one of the benefits of PAL is a safe learning environment, we deliberately decided not to have a summative evaluative assessment of this session. The sessions are a mandatory part of the clerkship, and the PAL format fosters an intrinsic accountability to fellow students such that students had an innate motivation to prepare for their roles as student teachers and learners.

This curricular evaluation was determined to be exempt from review by the University of Washington Human Subjects Division. We learned several lessons during initial implementation that helped us improve these sessions. We found that for a 90-minute educational session, it worked best to allocate groups of four students with 20 minutes for each case and debrief. We also found that a single faculty or resident supervisor could easily monitor and assist with three groups, or 12 fourth-year medical students. We added the color-coded folders to keep groups organized and ensure unique case representation in groups. Other updates that occurred during the implementation period in response to student and faculty insights included small medication adjustments, the addition of more electrocardiograms and radiology images, and minor clarifications in the wording in some guides.

IMPACT

Three EM faculty members with advanced training in medical education research iteratively developed a survey to assess the course. Validity evidence of this survey assessment was built upon Messick's validity framework.[14,15] The survey was based on the literature and

the theories underpinning PAL. It focused on three domains: content of the simulations, the students' experience guiding their simulation, and their experience learning from their peers. It was pilot tested for response process with four fourth-year medical students prior to survey administration, and their feedback was incorporated into the final version of the survey. Overall internal consistency of the survey was excellent with a Cronbach's alpha of 0.98, as was the internal consistency of each domain, with a Cronbach's alpha of 0.92, 0.94, and 0.95 respectively for content of the simulations, the students' experience guiding their simulation, and their experience learning with their peers.

A total of 160 students completed the course over an 11-month period between June 2016 and April 2017. One hundred thirty-five students completed the course evaluation survey for a response rate of 84%. Learner satisfaction was high with an overall score of 4.6 (standard deviation of 0.7) on a 5-point Likert scale with 88% of respondents either agreeing or strongly agreeing that their overall learning with peers in this format was a positive experience (Table 2). Students felt that the cases covered concepts appropriate for their level of training and that running a simulation for their peers was better for retaining new concepts than being a participant. They also responded that running the simulation did not require too much additional work or time. In written comments, students reported that small groups with minimal faculty involvement provided a safe learning environment and a unique opportunity to lead a group of their peers. In written comments, faculty reported that students remained engaged and required minimal oversight.

A limitation of our curricular evaluation is that we only measured Level 1 Kirkpatrick outcomes.[16] In future work, we plan to measure higher level outcomes, such as translation into practice with simulated assessments. Other future directions for this project include a pilot of distance participation in PAL simulations with students rotating concurrently in remote sites on their EM clerkships, using teleconferencing technology. We would also like to develop a non-summative knowledge assessment to evaluate if students are meeting the knowledge-based objectives of this session.

CONCLUSION

In summary, our EM clerkship peer-assisted learning case sessions were well received by both students and faculty and were feasible to implement. We anticipate that this curricular innovation could be readily implemented at other institutions with a small investment in tablets and the simulation application, or with other low-fidelity simulation options. We found that our PAL cases using low-fidelity simulation provide a cost-, resource- and time-effective way to implement an active medical student clerkship educational experience.

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Table 2. Peer-assisted learning survey results.

Statement posed to subjects (n=135)	Mean Score	Standard deviation	% Agree or Strongly Agree
The peer-guided simulations covered concepts that were appropriate for my knowledge base and experience	4.8	0.4	99%
Participating in the peer-assisted simulations helps me feel better prepared for my exams and clinical experience	4.5	0.7	91%
Participating in the peer-guided simulations will help me retain new concepts and skills better than faculty facilitated simulations	4.4	0.8	85%
Running a peer-guided simulation did not require too much additional work or time outside of this rotation	4.5	0.7	93%
Running a simulation for my peers will help me retain new concepts and skills better than just participating in a simulation	4.5	0.8	86%
Running a simulation makes me more likely to engage in teaching activities in the future	4.1	0.9	69%
My fellow students were well prepared to run the peer-guided simulations	4.3	0.8	84%
Overall, learning with my peers in this format was a positive experience	4.6	0.7	88%
I found the peer-guided simulations more interactive than previously experienced faculty facilitated simulations	4.2	1.0	74%

Ratings on 5-point Likert scale
1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree

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A Cognitive Apprenticeship-Based Faculty Development Intervention for Emergency Medicine Educators

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In just a few years of preparation, emergency medicine (EM) trainees must achieve expertise across the broad spectrum of skills critical to the practice of the specialty. Though education occurs in many contexts, much learning occurs on the job, caring for patients under the guidance of clinical educators. The cognitive apprenticeship framework, originally described in primary and secondary education, has been applied to workplace-based medical training. The framework includes a variety of teaching methods: scaffolding, modeling, articulation, reflection, and exploration, applied in a safe learning environment. Without understanding these methods within a theoretical framework, faculty may not apply the methods optimally. Here we describe a faculty development intervention during which participants articulate, share, and practice their own applications of cognitive-apprenticeship methods to learners in EM. We summarize themes identified by workshop participants, and provide suggestions for tailoring the application of these methods to varying levels of EM learners. The cognitive-apprenticeship framework allows for a common understanding of the methods used in clinical teaching toward independence. Clinical educators should be encouraged to reflect critically on their methods, while being offered the opportunity to share and learn from others. [West J Emerg Med. 2018;19(1)198–204.]

BACKGROUND

Emergency medicine (EM) trainees must achieve expertise across the broad spectrum of clinical skills critical to EM practice, achieving competence in only a few short years. While EM training includes didactics, self-directed learning, and periodic assessments, the key learning occurs while caring for patients under the supervision of experienced physicians. While early medical education often focuses on transmission and retention of data, learners must ultimately gain practical experience applying clinical reasoning, learning to work in teams, and approaching complicated problems and procedures. The understanding and strategic implementation of problem-solving strategies, heuristic approaches, and metacognitive skills leads to the type of understanding that allows the novice to become the expert.

The passing on of both domain and strategic knowledge happens through a process that other professions call an *apprenticeship*: a skill is first observed, then taught, and then practiced until mastery is achieved. To teach the art of medicine, however, we must also model and develop a set of cognitive skills. To do this requires a *cognitive apprenticeship*.

Introduced in the elementary and secondary education literature in the 1980s,[1,2] the cognitive-apprenticeship framework has been introduced into the medical education lexicon by Stalmeijer and others.[3] In a cognitive apprenticeship, the expert provides access to cognitive

strategies and skills and opportunities to explore. Cognitive apprenticeship encompasses the content, the sequential ordering of learning activities (increasingly diverse, increasingly complex), and the social characteristics of the community of practice.[4]

The overarching process of a cognitive apprenticeship is to provide *scaffolding* – just enough structural support that novices may begin to build their own skills and strategies. As a novice's skills solidify, this scaffolding is removed, until eventually trainees are able to practice independently. The cognitive apprenticeship includes a number of methods for providing cognitive supports, many of which may be familiar to teachers and learners in EM[5]:

- **Modeling-** Experts model the traits and behaviors they would like to see reflected in their learners. Experts make explicit what they intend to demonstrate; if they don't, learners may make mistaken assumptions. Modeling is a constant process. Successful modeling builds the foundation for increasing cognitive independence.
- **Coaching-** A clinical educator prepares his or her team for what to expect, makes adjustments based on the circumstances, provides guidance and feedback in real time, serves as motivator, mentor, and at times a taskmaster.
- **Articulation-** A learner must be able to articulate clinical reasoning so that educators may be sure that the understanding is complete. Experts must also articulate their own understanding, which may prove difficult once the processes have become automatic.
- **Reflection-** Reflection may not be automatic to some; educators should encourage learners to consider what an encounter has taught them, how their future approach could change, and how to apply what they've experienced to new problems.
- **Exploration-** Learners must be given room for exploration. True learning happens just beyond the boundaries of what's comfortable; learners should be encouraged to push those boundaries. Educators should urge learners to set goals to overcome weaknesses and build on strengths, and to regularly re-evaluate these goals in the context of new learning and new experience.

Though some educators may use these methods intuitively, most teachers in EM and other disciplines do not receive training in a theoretical understanding of clinical supervision. We believe that by understanding a theoretical framework and by being intentional in its application, educators may provide more effective scaffolding upon which learners may construct their working knowledge. With this goal in mind, this educational advance reviews the cognitive-apprenticeship model and its application to EM. Methods and materials are provided so that EM educators can run workshops with their faculty to train them in this method.

OBJECTIVES

We describe an interactive faculty development workshop designed to provide both an introduction to the cognitive-apprenticeship framework and an opportunity to reflect on its application in EM training. Stated objectives were the following:

- Compare a variety of techniques for providing cognitive support in the context of apprenticeship teaching and learning
- Anticipate the cognitive supports required by learners as they seek and attain entrustment
- Have discussed several techniques of cognitive support that can be incorporated into educational practice.

CURRICULAR DESIGN

We facilitated a series of faculty development workshops over the course of 2015-2017, including sessions aimed specifically at EM faculty at three consecutive annual meetings of the Society for Academic Emergency Medicine (SAEM), as well as sessions for multi-specialty teaching faculty at medical schools of the University of Michigan and Brown University. Each time the workshop was revised, primarily for ease of understanding and appropriateness of visual aids and visual content, based on feedback. The final version is described here. In one instance, participants received a brief publication in advance describing the cognitive-apprenticeship framework. This was not possible in other workshop settings.

An initial "Gallery Walk" activity (if time allows) serves to set the stage, activating participants' prior knowledge and identifying themes for facilitators to highlight throughout the discussion (Figure 1). At a series of stations, participants discussed teaching methods used in daily practice. Assuming that participants had no familiarity with the cognitive-apprenticeship model, a brief didactic presentation then laid out the scope of the model and provided working definitions for its methods so that participants could work within a shared framework using shared language.

Didactic elements were punctuated by individual reflection and small-group discussion among groups of 6-8 participants, each with 1-2 facilitators. In the first, participants were asked to reflect briefly on the application of these methods in their current educational practices, followed by facilitated group discussion comparing participants' experiences.

A second brief didactic element describes one framework for understanding learner advancement based on levels of entrustment. Participants worked in groups to discuss how these methods might be adjusted for learners of varying levels of expertise, suggesting revisions to the cognitive-apprenticeship model as initially presented. Using an informal debriefing process following each workshop, group facilitators identified broad themes from the resultant discussions. These themes, collected

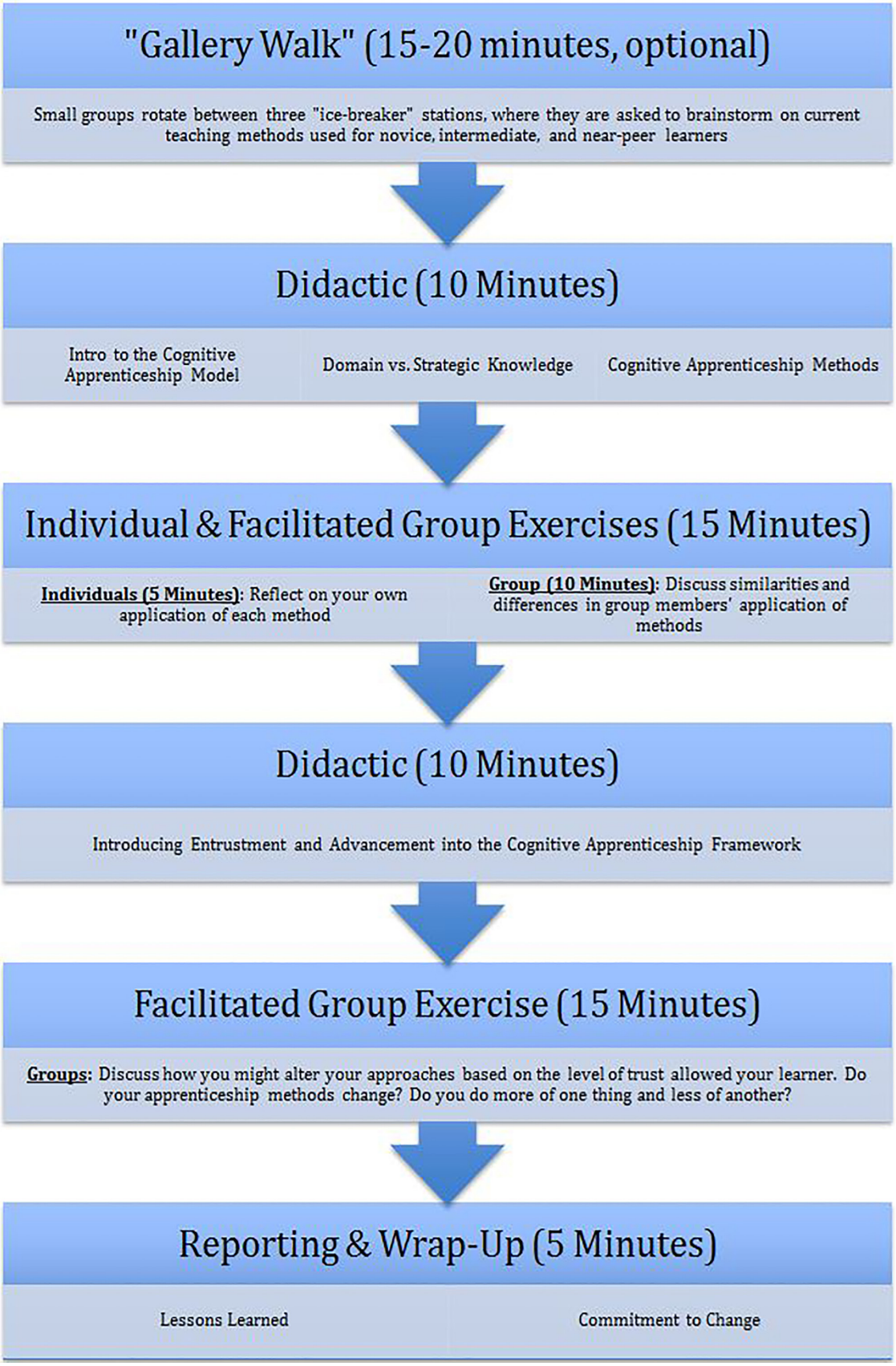

Figure 1. Schematic of the faculty development program, scaled for a one-hour presentation. Materials used for the didactic presentation, including a script and slides, are available from the authors upon request.

over successive iterations of this educational advance, have been tabulated for presentation here (Table), and are now provided as "talking points" to assist faculty facilitators in this workshop.

IMPACT AND EFFECTIVENESS

Nearly 90 participants have been estimated to have taken part in this series of faculty development sessions during 2016-2017. (Exact participation data was not available from the SAEM conferences.) Participants included resident learners as well as junior and senior faculty members. Overall evaluation from a subset of participants participating in the local, multi-specialty faculty development workshop presentations are shown in Figure 2.

Participants reported applying combinations of cognitive-apprenticeship methods depending upon the setting, timing and degree of experience of learners. We were able to identify broad trends in how the methods were applied by participants based on the level of learner being taught (Table). In narrative feedback, participants reported that by making the theoretical framework explicit, they recognized opportunities to be more intentional with their choices of methods and timing, and were better prepared to adjust their methods to better suit the needs of their learners.

Table. Application of cognitive-apprenticeship methods to varying levels of learners. From discussions held during several successive workshops, we identified several themes in educators' application of the cognitive-apprenticeship teaching methods. While the definition of learner levels (novice, mid-level, near-independent) is highly dependent on the learning context (a "novice" may be a preclinical medical student in one context or a first-year fellow in training in another context), the application of techniques may be adapted to each context.

Cognitive apprenticeship method	Description of teacher – learner interaction	Novice learner	Mid-level learner	Near-independent learner
Modeling	Expert performs a task so that learner can observe; the expert explains heuristics and control processes used in applying basic conceptual and procedural knowledge.	•Teaching/learning by observation •Example: Perform an H&P on a patient •Expert explains rationale behind specific actions	•Set the tone, always •Foster engagement in the healthcare team Expert explicitly models: •team communication •advanced patient care skills	•Expert demonstrates and debriefs system-level skills: •optimizing resources •collaborating with consultants •handling difficult patient interactions
Coaching	Expert prepares or observes learner during task performance and offers hints, scaffolding, feedback, reminders and new tasks aimed at bringing the learner's performance closer to expert performance.	•Help learners anticipate interactions using teaching scripts •Emphasize important considerations	•Challenge learners to improve •Provide guided practice •Give actionable feedback, hints, and reminders	•Provide a safe learning environment for theoretical discussions •Provide mentorship and advocacy to develop lifelong learning
Articulation	Both learner and teacher verbalize internal thought processes, focusing on the why in addition to the what.	•Articulate domain knowledge, basic medical reasoning •Teachers reinforce strengths, fill gaps •Use probing questions to diagnose the learner	•Articulate more advanced reasoning, providing support for actions •Teachers recognize multiple approaches, verbalize advantages of one over another	•Articulate systems-related processes or global thinking •Anticipate future needs of patients and systems •Plan prevention strategies
Reflection	Learners are encouraged to reflect on their own skills, for example in problem-solving or human interaction, as a means to identifying goals for improvement or change.	Reflect on learner's own reactions (e.g. "How did that make you feel? Why do you think you had that emotional response?")	Reflect on how interactions are influenced by previous experiences (e.g. "You've seen patients with this before. How can you improve on your management?")	Reflect on managing increasingly complex problems, using "what if?" questions.
Exploration	Learners develop their own learning goals, and begin to develop strategies to achieve these goals.	Explore general concepts or learning goals for discrete problems or complaints	Explore different management styles, even if the "path" differs from what the expert has in mind	Explore management strategies with little supervision or support, mirroring true independence

H&P, history and physical.

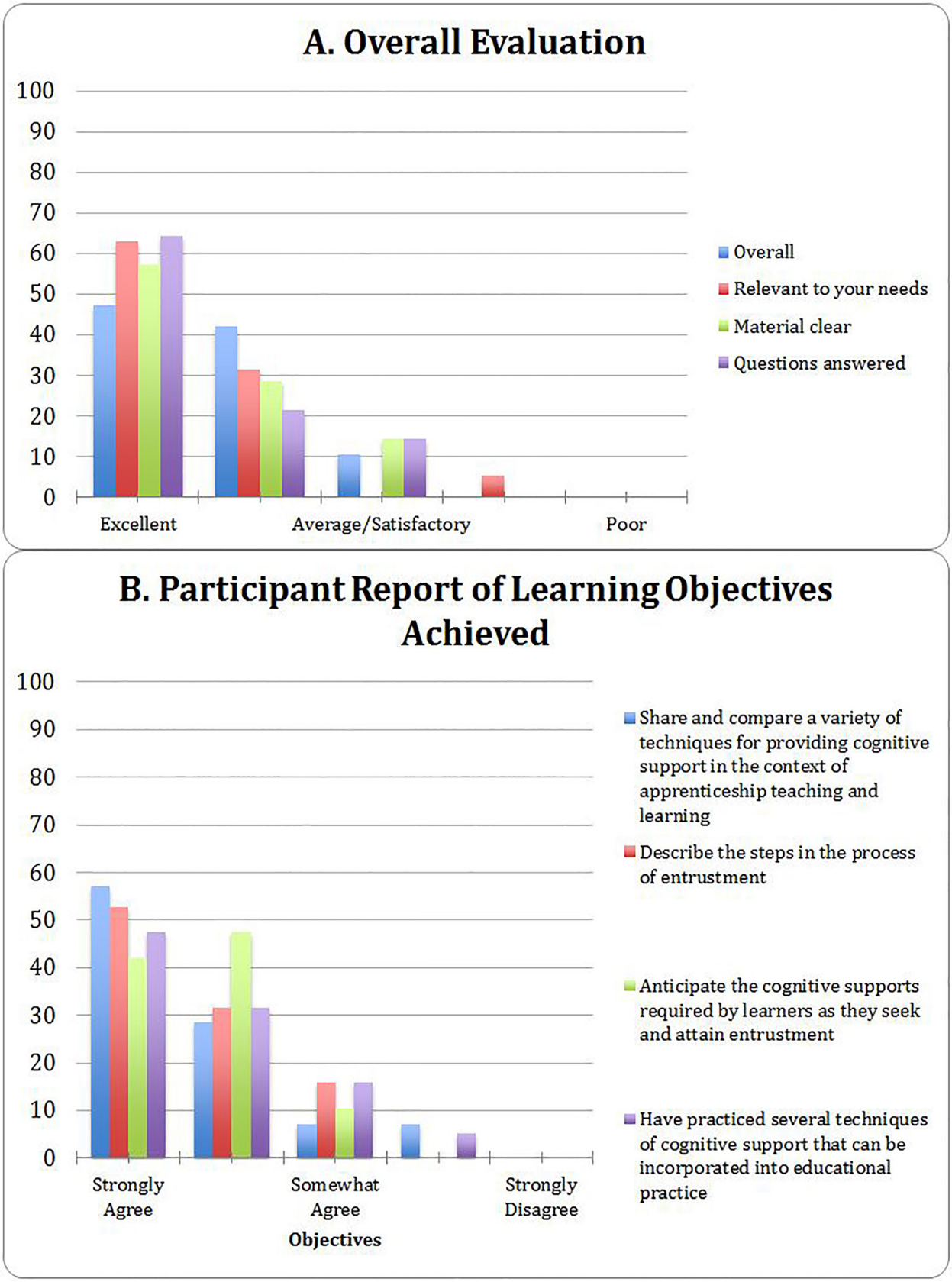

Figure 2. Participant evaluation of a cognitive apprenticeship-based faculty development workshop. Global evaluation of satisfaction (A) and achievement of learning objectives (B) during two early iterations of the faculty development workshop, reported as percentage of total respondents (n=19).

DISCUSSION

As learners negotiate the path from novice to expert, the clinician educator's role is to guide that path. As the teaching of the clinical practice of medicine remains very much an apprenticeship, the application of the cognitive-apprenticeship model has been shown to be acceptable to learners and educators alike, and indeed has been widely applied even if not explicitly named or recognized.[3,6-8]

We have described here a faculty development intervention aimed at helping educators reflect on and make explicit their understanding and application of the cognitive-apprenticeship model in EM education. From the workshop discussions, we have identified a number of patterns in how these methods are applied to education practice, varying depending on the level of learner involved:

- Novice learners will require the greatest degree of scaffolding. Novices learn from observation, coaching, and early articulation. Teachers model a range of approaches. Beyond demonstration, the expert must also articulate *why* he or she is focusing on certain elements. The novice learner can be coached to develop schema for various illness scripts, beginning to identify nuanced patterns. Reflection and exploration may be limited, but are important to gauging learner reactions, planning, and goal-setting. As learners develop, they will be able to apply these lessons to new and unfamiliar situations.
- For mid-level learners, workshop participants suggest that the focus of modeling shift from managing individual performance to managing the medical team. Setting a positive and collaborative "tone" between members of the patient care team is an important lesson. Likewise, the coach may begin to focus on action plans. As mid-level learners explore management approaches, real-time feedback allows the learner to achieve increasing competency. The coach also has a responsibility to motivate and challenge mid-level learners, providing learning opportunities within their zone of proximal development, encouraging reflection on how past experiences may influence present and future experiences.
- Near-independent learners can benefit from modeling of effective strategies to manage the healthcare system and advocate for patients. Effectively handling difficult conversations as well as directing care for patients with complex needs is the hallmark of the expert. Explicitly modeling how to listen and understand a patient's needs, advocate appropriately and "close the loop" with multiple partners will advance trainees' professional growth. The coach serves as mentor, sponsor, and advocate for the learner. Reflecting upon problems and strategies in a safe, supportive environment promotes continued lifelong learning.

This application of cognitive-apprenticeship strategies is consistent with others' observations. Examination of learners' preferences shows that teaching practices should evolve along with learners' degree of development, initially focusing more on the role of the supervisor, before gradually letting learners take charge.[9] The presence of a safe learning environment proves crucial, and learners respond to increasing independence differently depending on their sense of support.[10]

Implementation of this faculty development intervention requires that facilitators become familiar with the cognitive apprenticeship framework. Review of a few key pieces of literature may be sufficient to prepare to implement this in a local faculty development program.[4,6,9] The interactive nature of the discussion groups – which form the richest portion of the experience – may require only that facilitators are prepared with a few key questions to spur conversation or redirect discussions. Based on our experience, small groups positioned around a table work best with no more than eight discussants and at least one facilitator.

Groups have held rich discussions with both single-specialty or multi-specialty composition, though the direction of conversation may differ among these groups. In most cases, our presentations have been limited to one hour, though by allowing longer periods for group discussion it can easily be adapted to 90 minutes without substantial revision. In two presentations, an additional component – a "gallery walk" – was used as an opening ice-breaker (Figure 1), allowing participants to share practices and experience, and activating prior knowledge on which the group can build.

The true impact of the innovation presented here is significantly limited by the availability of reliable outcome data. Evaluation questions measured the participants' subjective responses rather than behavior changes as a result of the workshop. Stronger evidence for the effectiveness of the workshop could be obtained through more rigorous longitudinal assessment of participants. The evaluations reported are from the early iterations only, and similar data from the most recent presentations is not available. However, each presentation has stimulated rich discussion among clinician educators, and the format has not been altered significantly.

CONCLUSION

The methods and framework of the cognitive-apprenticeship model are recognized and accepted by clinical educators in emergency medicine. By providing an opportunity to articulate, reflect on, and explore the application of these methods in a safe learning environment of fellow educators in the faculty development setting, we have shown that rich discussions and sharing of strategies can be achieved. Clinical educators should be encouraged to reflect critically on their methods, while being offered the opportunity to share and learn from others. The cognitive-apprenticeship framework allows for a common understanding of the methods used in clinical teaching toward independence.

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Filling the Gap: Simulation-based Crisis Resource Management Training for Emergency Medicine Residents

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Introduction: In today's team-oriented healthcare environment, high-quality patient care requires physicians to possess not only medical knowledge and technical skills but also crisis resource management (CRM) skills. In emergency medicine (EM), the high acuity and dynamic environment makes CRM skills of physicians particularly critical to healthcare team success. The Accreditation Council of Graduate Medicine Education Core Competencies that guide residency program curriculums include CRM skills; however, EM residency programs are not given specific instructions as to how to teach these skills to their trainees. This article describes a simulation-based CRM course designed specifically for novice EM residents.

Methods: The CRM course includes an introductory didactic presentation followed by a series of simulation scenarios and structured debriefs. The course is designed to use observational learning within simulation education to decrease the time and resources required for implementation. To assess the effectiveness in improving team CRM skills, two independent raters use a validated CRM global rating scale to measure the CRM skills displayed by teams of EM interns in a pretest and posttest during the course.

Results: The CRM course improved leadership, problem solving, communication, situational awareness, teamwork, resource utilization and overall CRM skills displayed by teams of EM interns. While the improvement from pretest to posttest did not reach statistical significance for this pilot study, the large effect sizes suggest that statistical significance may be achieved with a larger sample size.

Conclusion: This course can feasibly be incorporated into existing EM residency curriculums to provide EM trainees with basic CRM skills required of successful emergency physicians. We believe integrating CRM training early into existing EM education encourages continued deliberate practice, discussion, and improvement of essential CRM skills. [West J Emerg Med. 2018;19(1)205–210.]

BACKGROUND

High-quality medical care of patients in the emergency department (ED) is dependent on teams of qualified healthcare providers. Emergency physicians have critical roles in the functioning of these teams. They must possess the medical knowledge and clinical skills needed to diagnose and treat high acuity medical conditions, but they must also possess the teamwork and interpersonal skills needed to successfully coordinate efficient team-based care in high-stakes situations. The skills that contribute to leadership, teamwork, communication, resource utilization and problem solving are frequently referred to as crisis resource management (CRM) skills and are increasingly

recognized as factors that impact patient safety in acute healthcare fields such as emergency medicine (EM).[1-5] Conversely, the lack of CRM skills has been implicated in adverse patient outcomes and malpractice cases.[5]

In the current era of outcomes-based medical education, the American Council for Graduate Medical Education (ACGME) requires EM residency programs to ensure trainees meet core competencies. The core competencies entitled "Interpersonal and Communication Skills" and "Systems-based Practice" involve various CRM skills such as teamwork, communication and resource utilization.[6] While residency programs are expected to teach and evaluate these skills, the ACGME does not specify how this training should be incorporated into residency education, and as a result many curriculums lack a dedicated plan for teaching these less tangible skills.

Historically, residents have been expected to learn CRM skills through role modeling, mentorship or trial and error using an apprentice-style approach to medical training.[7] However, better understanding of CRM suggests that these skills are teachable and measurable through more explicit approaches, similar to the medical knowledge and procedural skills taught across all residency programs.[8] To effectively equip trainees with the complete skillset needed to be successful, dedicated curricula designed to introduce, teach and reinforce CRM skills are warranted in residency education.

Several standardized team-training programs, such as "MedTeams" and "TeamStepps," have been developed and disseminated nationally.[5,9] The broad CRM skills in these courses are applicable to a wide variety of healthcare settings and disciplines. However, specific healthcare environments such as the ED and specific learners such as EM residents may warrant specialized CRM skills training.[10,11]

OBJECTIVES

Our first objective was to design a CRM course encompassing basic CRM principles critical to the practice of EM that could be feasibly incorporated into any EM residency curriculum. Our second objective was to evaluate the CRM course's efficacy in helping novice EM residents develop CRM skills. We conducted a pilot study to measure improvement in CRM skills displayed by teams of EM interns during the course.

CURRICULAR DESIGN

We conducted a literature review to explore existing courses that encompass CRM principles and determine which CRM skills should be included in this course. Despite discovering extensive lists of CRM skills pertinent to EM,[10-12] our search revealed just one previous CRM curriculum specifically designed for EM residents.[13] While the course was well received by participants, the authors did not attempt to measure the course's effectiveness in improving CRM skills.

Our CRM course consists of two key components: 1) an introductory lecture presentation, and 2) a series of six specialized simulation scenarios. The 30-minute lecture introduces the key concepts and history of CRM in aviation and in healthcare and highlights the increasing recognition of CRM's role in patient safety. The presentation also describes the specific roles of the leader and ED team members, and defines basic CRM terms such as "closed loop communication," "shared mental model," "workload management," and "situational awareness." Establishing this baseline knowledge aids in the discussions of CRM during debriefs of simulation scenarios and in the ED.

The majority of the CRM training involves a series of six high-fidelity simulation scenarios followed by structured debriefs. Various studies suggest that simulation is an ideal educational modality to teach and evaluate CRM skills.[7,10,14,15] Simulation not only introduces the importance of CRM skills, but also allows residents to deliberately practice the CRM skills in a safe environment where no patients are at risk.

The simulation cases in this course provide high-acuity EM situations that require effective CRM skills. The cases are designed to mimic the intense time pressures, rapidly evolving situations and high-acuity illnesses that are routinely experienced in the ED.[10,16] We chose all cases from our department's existing simulation case bank and modified them to meet specific learning objectives. The six cases used during this pilot course are described in the Supplemental Table. While each case has specific objectives for the medical management of each diagnosis, all cases incorporate the uniform CRM objectives listed in Table 1.

Each simulation scenario runs for 10-15 minutes followed by a 30-minute debrief by a single facilitator. The scenarios use either a standardized patient actor or the SimMan3G patient simulator, and cast simulation faculty as the nurse, family member or consultant. Following each scenario, a debrief is conducted by a facilitator and addresses both the medical management learning objectives, and the uniform CRM learning objectives within each scenario.

A randomized control study conducted in anesthesia CRM training showed that observers of a simulation scenario can gain the same improvement in CRM skills as active participants in the scenario.[17] With this in mind, our CRM course includes active participation in some scenarios as well as observation of other scenarios. More specifically, all teams participate separately in Case 1 and Case 6. Team performances in Case 1 provide pretest data, and team performances in Case 6 provide posttest data to measure the impact of the overall course. For Cases 2, 3, 4, and 5, only one team participates in the scenario while the remaining teams are observers. Observing teams are instructed to take notes on both the medical management and the CRM of the case. The facilitator then engages both the participating team and the observing teams in discussion during the debrief. The use of observational learning in four of the six cases minimizes the need for multiple simulation rooms, larger simulation and debriefing staff and time that would be required to allow every team to participate in every case separately.

Finally, to recreate the ad hoc nature of teams in the ED setting, this course randomly distributes residents into small teams at three separate times over the two-week period. Random and frequent shuffling of the teams recreates a more realistic working environment for our trainees and allows them to work with different peers in the various simulation cases.

IMPACT/EFFECTIVENESS

The pilot study of this course involved a cohort of 14 EM interns who participated in the simulation scenarios during four separate days in July 2016. This CRM course was a component of a larger two-week curriculum designed to provide an introduction to residency and to the clinical practice of EM. The institutional review board of our institution reviewed this study and determined that it was exempt from requiring informed consent of participants or ongoing review. The interns were randomly divided into four teams and these teams were redistributed three times over the course to replicate the ad hoc nature of ED teams. By the end of the course, each intern participated in a total of three cases and observed three additional cases.

During every simulation scenario, the CRM skills demonstrated by the participating team were evaluated by two independent raters using the Ottawa CRM Global Rating Scale (GRS). This CRM evaluation tool has been shown to have acceptable construct validity and interrater reliability[18,19] and has previously been used to measure the development of CRM skills in EM residents.[15] The Ottawa GRS provides a seven-point scale to evaluate the overall CRM performance and CRM skills in five specific categories: leadership, problem solving, situational awareness, resource utilization, and communication. Two trained EM faculty, both with extensive expertise in simulation education, acted as independent raters throughout the course. Both raters had used the Ottawa GRS in one prior study but did not receive any extensive training in the use of the tool. The same two raters were present for all simulation scenarios during the course.

Results of this pilot study suggest that this CRM course was effective in improving CRM skills among teams of novice interns; however, the improvements were not statistically significant. The median pretest and posttest scores and the data analysis for overall CRM scores and CRM category scores are presented in Table 2. We used Number Cruncher Statistical Software for the analyses.[20] Given that the unit of analysis is teams of interns and our sample size was N=4, we established a significance criterion of $\alpha = 0.05$. To control for Type I errors, we conducted Bonferroni corrections (corrected p-value = number of comparisons / $\alpha = 6 / 0.05 = 0.0083$).[21]

A Wilcoxon-signed rank test showed that the posttest scores for overall CRM performance were not statistically significantly higher than the pretest scores when using the Bonferroni corrected p-values. (All p-values were greater than the corrected $p = 0.0083$.) Similar data analysis for each category of CRM skills measured by the Ottawa GRS also demonstrated an improvement from pretest to posttest but also failed to meet statistical significance.

We calculated effect sizes to further aid in the interpretation of the data. The |r| effect size index was interpreted similar to a correlation coefficient |r|, with $|r| = 0.10$, 0.30 and > 0.50 interpreted as small, medium and large effects, respectively.[22] The improvements in overall CRM and each CRM category all showed large effect sizes ranging from $|r| = 0.581$ to 0.601. The large effect sizes detected for each dependent measure implies that the posttest scores would reflect a significant improvement over the pretest scores with an increased sample size.

We conducted an interrater reliability analysis using a kappa statistic with linear weighting to determine consistency between the two faculty raters. A single analysis of all pretest and posttest scores by the raters was used in the calculation of the kappa statistic. The interrater reliability for the raters was found to be kappa = 0.74, 95% CI (0.66, 0.82). This kappa value represents good agreement between the two raters in this study.[23]

Table 1. Simulation scenario crisis resource management objectives.

Category	Objective
Objective	Team member(s) verbally identify the leader within the first minute.
	The leader maintains a global perspective of the scenario.
Problem solving	Team member(s) verbalize a differential diagnosis prior to completion of the scenario.
Situational awareness	Team member(s) verbalize abnormal vital signs or significant changes in vital signs within two minutes
	A summary of the situation and plan going forward is verbalized for the entire team to hear (shared mental model).
Resource utilization	Tasks are clearly divided between members of the team.
	Consultant is provided with appropriate summary and specific requests for actions.
Communication	Team member(s) consistently use closed loop communication.
	Input from team members is elicited and considered.

Table 2. Pretest and posttest median scores using the Ottawa Crisis Resource Management Global Rating Scale (N=4) including descriptive and inferential statistics and effect sizes.

Dependent measure	Case 1-pretest (Mdn + IQR)	Case 6-posttest (Mdn + IQR)	Z-value	p-value*	|r|
Overall score	2.75 + 1.25	6.00 + 0.38	-1.657	0.049	0.586
Leadership	2.25 + 1.25	6.00 + 0.75	-1.657	0.049	0.586
Problem solving	2.50 + 2.25	6.25 + 0.88	-1.643	0.050	0.581
Situational awareness	2.75 + 0.88	6.25 + 1.63	-1.643	0.050	0.581
Resource utilization	2.75 + 1.63	6.00 + 0.75	-1.701	0.044	0.601
Communication	3.00 + 0.75	5.75 + 0.50	-1.657	0.049	0.586

Mdn, Median; *IQR*, Interquartile Range; |*r*|, effect size.
*All p-values are not significant with Bonferroni correction for Type I error rate inflation.

While pretest and posttest data were analyzed to determine the effectiveness of the CRM training, we also evaluated the CRM skills during Cases 2, 3, 4, and 5 to explore the potential value of the observational learning in this course. These scores were not included in the data analysis since only a single team actively participated in each of these cases while the remaining three teams observed. As shown in the figure below, each team showed an overall gradual improvement in CRM skills compared to the preceding teams, suggesting that observational learning of CRM was effective in this setting.

The results support previous evidence that simulation is an effective educational modality to teach CRM skills and that observational learning in simulation is an effective tool to optimize training and minimize the time and resources required. Furthermore, this course can be easily incorporated into existing EM residency educational curriculums since it is designed to be feasible with one simulation room, a single simulation debriefing facilitator, and minimal other staff or faculty to serve as confederates in the scenarios. It is an option for any EM residency without access to a large simulation center.

While these results suggest that CRM skills can be significantly improved through a short simulation-based educational intervention, there are a number of limitations. This study is limited by the small sample size and the setting of a single EM residency program. The CRM principles introduced and evaluated in this course reflect just a subset of those CRM skills needed for EM. It is our belief that adding basic CRM to the vocabulary and skillset of an EM intern sets the stage for continued appreciation, deliberate practice, and ongoing improvement of CRM skills during training and throughout a career in EM.

This pilot study also does not assess the retention of the CRM skills beyond the two-week course. Additional testing over multiple years of residency training would be valuable in detecting improvement and retention of CRM skills over time. Ultimately, further studies would be beneficial to determine if the CRM skills achieved through simulated scenarios affect behaviors or success of residents in the ED.

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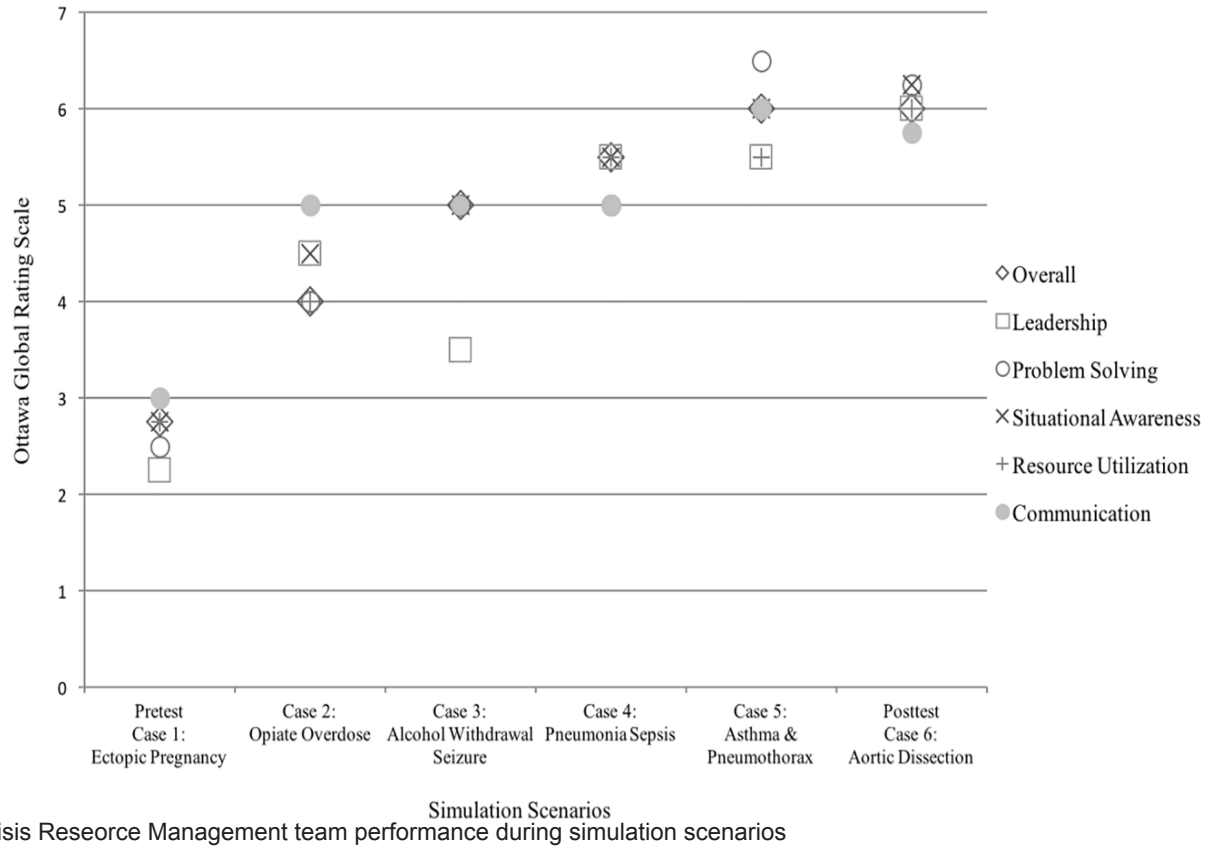

Figure. Crisis Reseorce Management team performance during simulation scenarios

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Preparing Emergency Medicine Residents to Disclose Medical Error Using Standardized Patients

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Introduction: Emergency Medicine (EM) is a unique clinical learning environment. The American College of Graduate Medical Education Clinical Learning Environment Review Pathways to Excellence calls for "hands-on training" of disclosure of medical error (DME) during residency. Training and practicing key elements of DME using standardized patients (SP) may enhance preparedness among EM residents in performing this crucial skill in a clinical setting.

Methods: This training was developed to improve resident preparedness in DME in the clinical setting. Objectives included the following: the residents will be able to define a medical error; discuss ethical and professional standards of DME; recognize common barriers to DME; describe key elements in effective DME to patients and families; and apply key elements during a SP encounter. The four-hour course included didactic and experiential learning methods, and was created collaboratively by core EM faculty and subject matter experts in conflict resolution and healthcare simulation. Educational media included lecture, video exemplars of DME communication with discussion, small group case-study discussion, and SP encounters. We administered a survey assessing for preparedness in DME pre-and post-training. A critical action checklist was administered to assess individual performance of key elements of DME during the evaluated SP case. A total of 15 postgraduate-year 1 and 2 EM residents completed the training.

Results: After the course, residents reported increased comfort with and preparedness in performing several key elements in DME. They were able to demonstrate these elements in a simulated setting using SP. Residents valued the training, rating the didactic, SP sessions, and overall educational experience very high.

Conclusion: Experiential learning using SP is effective in improving resident knowledge of and preparedness in performing medical error disclosure. This educational module can be adapted to other clinical learning environments through creation of specialty-specific scenarios. [West J Emerg Med. 2018;19(1)211–215.]

BACKGROUND

Emergency medicine (EM) is a high-risk clinical learning environment with reported rates of medical errors between 18% [1] to 32%.[2] Unique challenges such as frequent interruptions, multiple transitions of care, time constraints, simultaneous management of multiple complex patients, decisions based on incomplete information, unfamiliar physician-patient relationship, and a lack of privacy increase the risk of medical errors and create barriers to effective identification and disclosure when errors occur.[3,4]

The ability to effectively disclose medical errors (DME) is crucial in EM. The 2010 American College of Emergency Physicians Policy Statement on Disclosure of Medical Errors [5] directs emergency physicians who determine an error has occurred to provide timely information about the error and its consequences to patients and their families. Despite this mandate, a disclosure gap exists in EM. When surveyed, 88% of emergency department (ED) patients in one academic setting desired full disclosure of the error and 63% of patients endorsed teaching physicians error disclosure techniques, honesty, and compassion as educational priorities.[6] However, a survey of 55 EM residents from two programs demonstrated infrequent, inadequate disclosure to patients and families, occurring in only 28% of cases.[7]

To close the disclosure gap, the Accreditation Council for Graduate Medical Education (ACGME) has called for improved education surrounding DME during residency training. The ACGME Clinical Learning Environment Review (CLER) Pathways to Excellence [8] calls for "hands-on training" of DME, and the 2017 EM program requirements [9] state "residents must receive training in how to disclose adverse events to patients and families [and] should have the opportunity to participate in the disclosure of patient safety events, real or simulated" as a necessary educational component of the Clinical Learning and Working Environment.

Though the use of standardized patients (SP) in DME training has been described in other specialties,[10-13] there is sparse literature addressing DME training using SP specific to the EM clinical environment.[14] The purpose of the study was to determine if offering this type of training improved EM residents' ability to DME in the ED setting.

OBJECTIVES

The primary objective of this course was to provide EM residents education and hands-on training in DME. We estimated that after this training, participants would report improved knowledge, skills, and attitudes surrounding DME in the ED. Specific objectives were as follows:

1. Define what constitutes a "medical error" and "adverse event"
2. Discuss the ethical arguments and professional standards dictating DME
3. Recognize common barriers to effective DME
4. Describe key elements in the effective DME to patients
5. Apply these key elements during a variety of simulated encounters
6. Employ effective communication skills targeted to DME.

This training was developed to address CLER Patient Safety Pathway 7,[8] which recommends that residents be provided training related to disclosure of safety events within the clinical setting.

CURRICULAR DESIGN

We designed this course using the "flipped-classroom" model of adult learning. Participants were provided didactic materials [3,4] for review prior to course attendance. These materials were chosen by the clinical subject matter experts (SME) in collaboration with the healthcare resolution SME.

The course was a four-hour session, developed in collaboration with clinical, healthcare resolutions, and healthcare simulation SME. The course consisted of didactic review (30 minutes), video vignette review with debrief (30 minutes) and standardized patient (SP) encounters (2.5 hours). The remaining 30 minutes were dedicated to course evaluation and survey completion. There were five practice SP encounters and one SP encounter for final assessment. During the practice sessions, participants were broken into small groups and rotated through five scenarios. Each vignette took approximately five minutes, after which the small group participated in a debrief lasting approximately 10 minutes, facilitated by the SP. The simulation SME rotated through each station to proctor at least one debriefing session for each case. The course culminated in a standardized scenario, in which each resident interacted with the SP individually, and the SP provided formal written feedback on their performance.

Case scenarios were developed by clinical SME with assistance from healthcare resolutions and healthcare simulation SME. They provided a variety of medical error situations and patient populations. Scenarios included these:

1. Computed tomography ordered on wrong patient with contrast allergy[15]
2. Pneumothorax requiring chest tube placement after central line
3. Wrong patient information (lab result) given to patient and family
4. Failure to review allergies and wrong medication ordered
5. Epinephrine administration IV instead of IM
6. Wrong dose of insulin with hypoglycemic seizure.

The following is an example of the background provided to the residents prior to engaging in the simulation scenario:

Scenario 5

A 12-year-old boy with history of multiple allergies presents with hives on his face, swollen lips, and is complaining of a hoarse voice and progressive throat tightness after exposure to an unknown allergen at school. He ambulated into the ED and is speaking in full sentences after receiving oral diphenhydramine in triage. Vital signs on presentation are stable. The physician gives the following verbal orders: 0.3 mL of epinephrine 1:1000 IM, methylprednisone 2 mg/kg IV, ranitidine 1 mg/kg IV. The nurse draws up the medications and gives the IV medications first. When she prepares to give the intramuscular epinephrine,

she realizes the epinephrine was administered via IV. The patient begins complaining of severe chest pain, appears diaphoretic, and shows abnormal vital signs. The nurse notifies you of the error. A 12-lead electrocardiogram is performed and reveals ST segment elevation. The patient is treated with supplemental oxygen and sublingual nitroglycerin. Reassessment reveals resolution of the angioedema, ST segment elevation, and chest pain. The vital signs stabilize. The patient is admitted to the PICU for observation. The mother is very upset and demands to know what happened.

Assessment of learning included surveys completed by the participant and checklists completed by the SP. The pre- and post-test surveys measured self-efficacy in their confidence and preparedness in performing key skills in DME.[10] In addition to being trained to their specific roles, SPs were trained by the healthcare simulation SME to provide feedback on each participant's performance in the final scenario using a published simulation assessment tool.[16,17]

IMPACT/EFFECTIVENESS

Of the 15 post-graduate year 1 and 2 residents who participated in this course, 66% reported prior DME training, of whom only 13% reported the use of simulation. After the course, residents reported increased preparedness in performing several key elements in DME (Table 1) and demonstrated the ability to apply these key elements during a SP encounter (Table 2). Residents reported this training to be valuable, rating the didactic, SP sessions, and overall educational experience very high (mean scores 4.2, 4.5, and 4.4 respectively; Likert scale, 1=not at all useful, 5= very useful). These results suggest experiential learning using SP is effective in improving resident knowledge of and preparedness in performing DME.

LIMITATIONS

This pilot course introduced a new and important element to EM residency training. While initial results are encouraging, there are important limitations to consider. Due to faculty unavailability, we were unable to allow for multiple raters, which would have allowed for a more objective assessment of the residents' performance. Residents were offered reading materials prior to the course, and the faculty relied on self-report to determine whether or not the residents reviewed the materials. Many of the metrics were self-reported, which is less robust than more objective data. Although the objective data provided by the SP is more robust, because there was no pre-course scenario, it was difficult to determine whether this training was the sole source of that level of performance, especially considering that many had previous DME training. Despite these limitations, we believe this course provided a meaningful way to allow for safe practice of DME with robust feedback, and faculty and residents both reported the desire for repeated immersive training in this area.

As this was the first iteration of this course, we had only a small number of participants with limited data. However, our results mirror previous studies, reporting improved self-efficacy[10] and performance[11-13] of DME after SP interactions. Likewise, similar to studies in which educational value was assessed,[10,12,13,18] our participants reported the training to be beneficial. While a single course offering may not result in long-term retention of these concepts, the most appropriate timeline for refresher training is unclear. We plan to offer this course annually to reinforce these concepts throughout residency training.

Post-simulation debriefing is widely regarded as essential to skill acquisition and retention.[20] While our course used the trained SP, rather than faculty, to provide

Table 1. Self-efficacy in error disclosure among 15 emergency medicine residents.

"How prepared do you feel to perform each variable during the disclosure of a medical error?"	Score* mean (SD)		Residents improved, n (%)	P value
	Pre	Post		
Know what to include	2.5 (0.6)	4.4 (0.7)	15/15 (100)	p < 0.001
Introduce the topic with a patient	2.9 (1)	4.3 (0.5)	13/15 (87)	p < 0.001
Deal with a patient's emotional response	3.1 (1)	3.9 (0.6)	10/15 (67)	p = 0.005
Express empathy	3.9 (0.6)	4.2 (0.6)	8/15 (53)	p = 0.05
Respond to a patient's questions	3.1 (0.7)	3.9 (0.6)	10/15 (67)	p = 0.003
Address patient concerns about consequences of error	2.5 (0.9)	3.9 (0.7)	11/14 (79)	p < 0.001
Deal with legal questions	1.7 (0.7)	2.7 (0.9)	10/15 (67)	p < 0.001
Recognize your own emotions	3.6 (0.9)	4.1 (0.8)	7/14 (50)	p = 0.006
Keep your emotions in check	3.5 (0.8)	4.2 (0.7)	9/15 (60)	p < 0.001

*Score ranges from 1 (lowest; not at all prepared) to 5 (highest; very well prepared), expressed in mean (SD), p-value using paired t-test. Survey adapted from Bonnema R et al. *J Grad Med Educ.* 2009;1(1):114

Table 2. Critical action checklist for key elements in medical error disclosure.

Critical action	Score		Score mean (SD)
	1 = very poor	5 = excellent	
Conducts explicit disclosure of error to patient	Does not explicitly explain that an error took place and the patient had suffered as a result	Describes the nature and source of the error and consequences of the error to the patient and/or family members	3.6 (0.6)
Responds forthrightly to patient's questions about the event	Avoids direct responses to a family member's question	Responds truthfully to the patient and/or family member's questions	4.0 (0.4)
Apologizes upfront and early in conversation	Does not apologize up front	Apologizes to the patient and family member at the beginning of the disclosure conversation	4.4 (0.5)
Exhibits general communication skill with the patient	Remains aloof and distant to family member's emotional distress	Displays verbal and nonverbal empathy and support of the patient and family member	3.9 (0.5)
Conducts blame-free disclosure, acknowledges personal role	Blames a team member in front of the family member	Avoids blaming of other team members, resists patient and/or family members attempts to affix blame	4.1 (0.6)
Offers plans to prevent future errors	Does not address specific plans for preventing future errors	Explains to patient and/or family member what will be done to prevent such errors from occurring in the future	3.8 (0.7)
Plans follow up with patient	Does not offer to follow up with the family member	Offers to follow up with the patient and family member for other potential questions they may have	3.9 (0.6)

Adapted from Kim et al. *Teaching and Learning in Medicine* 2011;23(1):68 and Biberston K et al. Error Communication: Discover barriers, Share best practices and Lead change with simulation. IMSH 2016.

feedback during debriefing, previous studies have shown that the SPs can provide accurate assessments of interpersonal communication skills.[21, 22] Additional studies have demonstrated that with proper training, SP scores correlate highly with faculty experts.[23] The SP training included a 45-minute session on facilitating debriefing using a published debriefing guide[24] and giving feedback using the TeamSTEPPs feedback model.[25]

CONCLUSION

Disclosing medical error, regrettably, is a skill that physicians in nearly every medical specialty will be required to perform at some point in their careers. Suboptimal DME can have lasting detrimental effects on patients, their families, and the healthcare team. Experiential learning using SP is a well-documented method for teaching various forms of communication skills[18, 19] and has demonstrated effectiveness in teaching DME in specialties outside of EM.[10-14] Disclosing medical error is a stressful endeavor for EM residents.[7] Immersive training via SP affords the opportunity to practice a critical and emotionally uncomfortable skill in a safe environment. It is our hope that the general content and format of this course will be replicated in other graduate medical education programs to help future physicians perform this difficult and emotionally charged responsibility.

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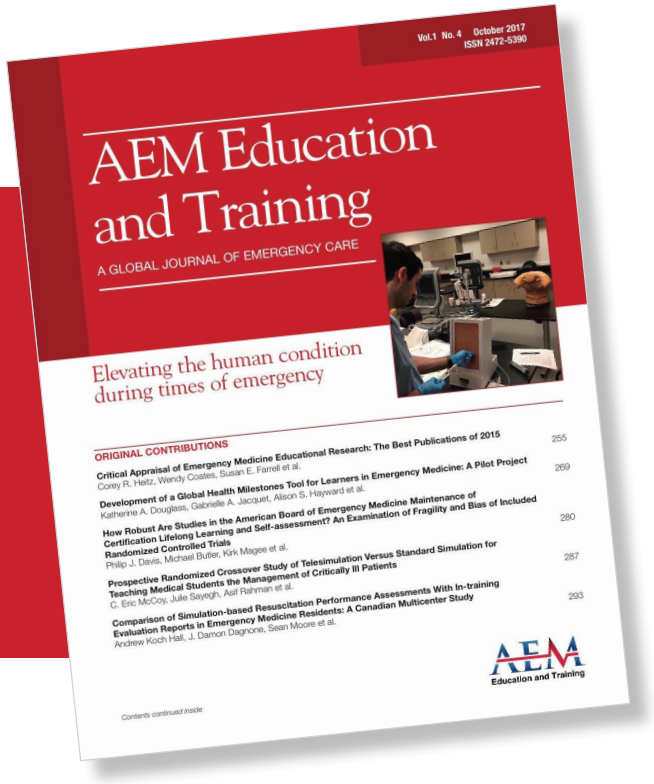

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