Advances in Medical Education and Practice

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ORIGINAL RESEARCH

# A suggested emergency medicine boot camp curriculum for medical students based on the mapping of Core Entrustable Professional Activities to Emergency Medicine Level 1 milestones

This article was published in the following Dove Press journal:
Advances in Medical Education and Practice
1 March 2016
Number of times this article has been viewed

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**Background:** An increasing number of students rank Emergency Medicine (EM) as a top specialty choice, requiring medical schools to provide adequate exposure to EM. The Core Entrustable Professional Activities (EPAs) for Entering Residency by the Association of American Medical Colleges combined with the Milestone Project for EM residency training has attempted to standardize the undergraduate and graduate medical education goals. However, it remains unclear as to how the EPAs correlate to the milestones, and who owns the process of ensuring that an entering EM resident has competency at a certain minimum level. Recent trends establishing specialty-specific boot camps prepare students for residency and address the variability of skills of students coming from different medical schools.

**Objective:** Our project's goal was therefore to perform a needs assessment to inform the design of an EM boot camp curriculum. Toward this goal, we 1) mapped the core EPAs for graduating medical students to the EM residency Level 1 milestones in order to identify the possible gaps/needs and 2) conducted a pilot procedure workshop that was designed to address some of the identified gaps/needs in procedural skills.

**Methods:** In order to inform the curriculum of an EM boot camp, we used a systematic approach to 1) identify gaps between the EPAs and EM milestones (Level 1) and 2) determine what essential and supplemental competencies/skills an incoming EM resident should ideally possess. We then piloted a 1-day, three-station advanced ABCs procedure workshop based on the identified needs. A pre-workshop test and survey assessed knowledge, preparedness, confidence, and perceived competence. A post-workshop survey evaluated the program, and a posttest combined with psychomotor skills test using three simulation cases assessed students' skills.

**Results:** Students (n=9) reported increased confidence in the following procedures: intubation (1.5–2.1), thoracostomy (1.1–1.9), and central venous catheterization (1.3–2) (a three-point Likert-type scale, with 1= not yet confident/able to perform with supervision to 3= confident/able to perform without supervision). Psychomotor skills testing showed on average, 26% of students required verbal prompting with performance errors, 48% with minor performance errors, and 26% worked independently without performance errors. All participants reported: 1) increased knowledge and confidence in covered topics and 2) overall satisfaction with simulation experience.

**Conclusion:** Mapping the Core EPAs for Entering Residency to the EM milestones at Level 1 identifies educational gaps for graduating medical students seeking a career in EM. Educators designing EM boot camps for medical students should consider these identified gaps, procedures, and clinical conditions during the development of a core standardized curriculum.

**Keywords:** emergency medicine, clerkship, medical education, competency, EPA 10, milestones

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http://dx.doi.org/10.2147/AMEP.S97106

## Introduction

Emergency Medicine (EM) has experienced unprecedented growth in graduate medical education with the expansion of residency programs nationwide.[1] An increasing number of US medical students rank EM as a top specialty choice.[1] Undergraduate programs are incorporating EM experiences in their curricula, but the addition of mandatory, structured EM clerkships still remains an area of slow growth.[2,3] Unlike primary-care specialties such as Internal Medicine or Pediatrics where core standardized clerkship curricula ensure that each graduating US medical student has certain knowledge and skills related to that discipline, this is not so for EM. Medical schools may offer elective EM experiences, but these may have wide variability in goals, settings, and focus, as evidenced by differences between community versus tertiary-care center rotations, pediatrics versus adult EM experiences, and exposure to trauma and ultrasound. Therefore, currently, there may be considerable variability from one medical school graduate to another in the knowledge and skills related to EM.

Program directors across specialties are concerned over the variability in skill sets and lack of preparedness of incoming residents.[4] In response to these concerns, efforts are being made to better define expectations during physician training with the development of the Core Entrustable Professional Activities (EPAs) for Entering Residency by the Association of American Medical Colleges (AAMC).[5,6] The EPAs are a clear, concise list of what graduating medical students should be entrusted to do without direct supervision on DAY ONE of any residency.[7,8] The entrustment in the tasks of professional practice is important to note and means that a student can perform the task unsupervised.[7,8] EPAs therefore define activities of an entrusted learner and offer a clear definition of what is expected and what can be measured and observed, once a competency has been achieved, regardless of specialty. For example, gather a history and perform a medical examination is a discrete measurable EPA. There are 13 EPAs currently defined and each includes a list of expected behaviors and vignettes that describe the entrustable learner. While every EPA applies to a resident entering EM training, EPA 10 states Recognize a patient requiring urgent or emergent care and initiate evaluation and management, which typifies a core competency of EM.

As part of the New Accreditation System, the American Board of Emergency Medicine (ABEM) and the Accreditation Council for Graduate Medical Education (ACGME) established 23 milestones that EM residents are expected to achieve to varying levels throughout their training.[9] Milestones are knowledge, skills, and attitudes for each of the competencies such as patient care (PC), professionalism (PROF), and interpersonal and communication skills (ICS), organized in a developmental framework from less to more advanced. They describe tasks for evaluating the performance of a resident from entry into residency through graduation. Level 1 is expected of an incoming resident, Level 4 is a target for graduating residents, and Level 5 is aspirational and a target for an independent, practicing, EM physician.[9]

Currently, residency program leadership, in conjunction with the ACGME-mandated Clinical Competency Committee, determines individual resident competence with regard to milestones. However, with incoming residents, there is a significant lag of 6–12 months before they can be adequately assessed on all Level 1 milestones. To address the potential gaps and variations in the medical school training of incoming residents, most residencies employ variations of an intern orientation. While the end point of this approach is to standardize the level of the incoming residents, it is challenging to accurately gauge their beginning level of familiarity and competence and tangible deficits do exist.[10]

To develop discipline-specific competencies for graduating medical students, there has been a recent trend to establish specialty-specific boot camps – currently advocated primarily by surgical specialties.[11–14] The goal of these boot camps is to provide individualized learning, prepare students for entering residency, and address the variability of skills of students attending the program from different medical schools. A recent meta-analysis evaluating the literature on 15 such boot camps showed that participants had significant improvements in clinical skills, knowledge, and confidence.[14]

An EM boot camp may be necessary to prepare medical students who match into EM.[10] It is, however, not clear as to what gaps currently exist in the undergraduate medical curricula, and therefore, what issues need to be addressed in this boot camp. Our project's goal was therefore to perform a needs assessment to inform the design of an EM boot camp curriculum. Toward this goal, we 1) mapped the core EPAs for graduating medical students to the EM residency Level 1 milestones in order to identify the possible gaps/needs and 2) conducted a pilot procedure workshop that was designed to address some of the identified gaps/needs in procedural skills.

Since institutional variability exists, we used the hypothesis that the core EPAs outline competencies for every graduating medical student (regardless of medical school) and provide mapping to the EM milestone Level 1 competencies for an entering resident, which will help us identify some

of the overall gaps. Based on a literature review, we also identified core procedural skills and areas of critical importance for the clinical practice of EM and finally, described our pilot EM procedure boot camp.[6,9,15,16]

## Methods

Institutional review board approval and participant consent was not necessary for this study, as the work was part of an elective curriculum. Description of the needs assessment for EM boot camp curriculum, mapping, and procedure workshop is detailed in the following section:

### Needs assessment for EM boot camp curriculum

A systematic approach was used in order to identify the gaps in medical education and to identify topics that would be essential for inclusion in an EM boot camp curriculum. This approach was centered on: 1) identifying gaps between the EPAs and EM milestones (Level 1) and 2) determining what essential and supplemental competencies and skills an incoming EM resident should ideally possess. Based on this information, a pilot 1-day EM procedure boot camp was implemented to address procedural skills and to assess interest and effectiveness. A 2-week structured EM boot camp curriculum is now being conceptualized based on this needs assessment and is planned for implementation in the academic year 2016.

### Mapping of EPAs to EM Level 1 milestones

The authors, with expertise in both undergraduate and graduate medical education, collectively reviewed the EPAs and EM milestones. The individual milestones were sequentially mapped to EPAs based on a review of milestones under each sub-competency (Table 1). Each EPA is addressed by at least one EM milestone, while some milestones map to multiple EPAs. However, some milestones are not addressed by any of the EPAs. Table S1 describes mapping in further detail.

### Identification of core procedural skills

We reviewed existing procedural EM milestones and identified an additional list of core procedures that all incoming first-year EM residents should have exposure to and some ability to perform with supervision – not competence. This list was further advised by existing literature (Table 2).[15]

**Table 1** Core Entrustable Professional Activity (EPA) for Entering Residency vs ACGME milestones for emergency medicine residents[6,9]

| | EPA 1 | EPA 2 | EPA 3 | EPA 4 | EPA 5 | EPA 6 | EPA 7 | EPA 8 | EPA 9 | EPA 10 | EPA 11 | EPA 12 | EPA 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PC1 | | | | | | | | | | X | | | |
| PC2 | X | | | | | X | | | | | | | |
| PC3 | | | X | | | | | | | | | | |
| PC4 | | X | | | | | | | | | | | |
| PC5 | | | | X | | | | | | | | | |
| PC6* | | | | | | | | | | | | | |
| PC7* | | | | | | | | | | | | | |
| PC8 | | | | | | | | | | X | | | |
| PC9 | | | | | | | | | | | X | X | |
| PC10* | | | | | | | | | | | | | |
| PC11* | | | | | | | | | | | | | |
| PC12* | | | | | | | | | | | | | |
| PC13* | | | | | | | | | | | | | |
| PC14 | | | | | | | | | | | | X | |
| MK | | | | | | | | | | X | | | |
| SBP1 | | | | | | | | | | | | | X |
| SBP2 | | | | | | | | | | | | | X |
| SBP3 | | | | | X | | | | | | | | |
| PBLI | | | | | | | X | | | | | | |
| PROF1 | X | | | | | | | | | | | | |
| PROF2* | | | | | | | | | | | | | |
| ICS1 | X | | | | | | | | | | | | |
| ICS2 | | | | | | X | | X | X | | | | |

**Notes:** An "X" at the intersection indicates that the milestone is specifically covered by that EPA. *Indicates milestones that did not map to an EPA.
**Abbreviations:** EPA, Entrustable Professional Activity; PC, patient care; MK, medical knowledge; SBP, systems-based practice; PBLI, practice-based performance improvement; PROF, professionalism; ICS, interpersonal and communication skills; ACGME, Accreditation Council for Graduate Medical Education.

## Identification of key clinical conditions requiring reinforcement

Clinical conditions in EPA 10 were reviewed and supplemented with ten emergent conditions recommended by the Clerkship Directors in Emergency Medicine (CDEM) Curriculum Revision Group.[16] Author consensus determined the core list to be included in the EM boot camp curriculum (Table 3).

## Pilot 1-day EM procedure boot camp

In this pilot boot camp, we focused on one aspect of the EM boot camp curriculum for graduating medical students: core procedures fundamental to EM practice. The procedure boot camp was a voluntary, noncredit full-day event. The curriculum had goals and objectives centered on the concept of advanced ABCs. A pretest and survey assessing knowledge and preparedness, confidence, and perceived competence were conducted prior to the workshop. We used a flipped classroom approach where students were expected to review procedures using posted text and videos prior to the session. In a traditional lecture method, the material is presented in the classroom and students later apply this knowledge on their own. Flipping the classroom is different since students gain exposure to material or content outside of class, usually via prereading or online videos, and use class time with a facilitator to apply that knowledge, through problem-solving and practice of skills. The hands-on practice was conducted at three stations in our Simulation Center using task trainers and animal models such as porcine tracheas and ribs (Table 4).

A posttest and a psychomotor skills test were performed using three simulation cases to assess the competence of students in practicing ABC skills (Table S2 – sample checklist for intubation). A post-workshop survey assessed student perception and satisfaction (Table S3).

**Table 2** Procedures[9,15]

| Milestone-guided procedural skills (Level 1) | Supplemental procedures warranting exposure |
|---|---|
| Arterial puncture | Basic life support |
| Bag-valve mask ventilation | Cricothyrotomy |
| Basic airway management | Direct and video laryngoscopy |
| Emergency ultrasound – indications only | Electrocardiogram interpretation |
| Local anesthesia | Intraosseous catheter insertion |
| Peripheral intravenous line | Paracentesis |
| Simple interrupted suture | Plain radiography (X-ray) interpretation |
| Venipuncture | Rescue airways |
| | Thoracentesis |
| | Thoracostomy tube placement |
| | Ultrasound-guided central line placement |
| | Ultrasound-guided peripheral intravenous line |

**Table 3** Clinical conditions[6,16]

| EPA 10 guided | Supplemental conditions |
|---|---|
| Chest pain | Abdominal pain |
| Electrolyte abnormalities | Cardiac arrest |
| Fever | Gastrointestinal bleeding |
| Hypoglycemia and hyperglycemia | Headache |
| Hypotension and hypertension | Poisoning |
| Mental status changes | Respiratory distress |
| Oliguria, anuria, and urinary retention | Shock |
| Shortness of breath and hypoxemia | Trauma |
| Tachycardia and arrhythmias | |

**Abbreviation:** EPA, Entrustable Professional Activity.

# Results

Nine of the 15 EM-matched seniors at our institution attended the voluntary, noncredit procedure workshop. The majority of students reported their motivation as "I don't want to suck come July" when residency starts. They held expectations of becoming more comfortable with the procedures, and did not expect competence to develop in 1 day. A post-workshop survey assessed student perception and satisfaction on six domains: meeting objectives, training environment, simulation equipment/supplies, instructor preparedness/facilitation, knowledge acquisition/application, and overall experience. All (100%) participants reported satisfaction with the overall simulation experience, felt the workshop met goals, and increased their knowledge and confidence in topics covered. Additionally, 100% of the participants felt the content covered was appropriate for their level of training. Students reported an increased confidence post-workshop in the following procedures: intubation (1.5–2.1), thoracostomy (1.1–1.9), and ultrasound-guided central venous catheterization of internal jugular vein (1.3–2) (a three-point Likert-type scale, with 1= not yet confident/able to perform with supervision to 3= confident/able to perform without supervision). Psychomotor skills testing of procedures showed that on average, 2.3 (26%) of students required verbal prompting with performance errors, 4.3 (48%) worked independently with minor performance errors, and 2.3 (26%) worked independently without performance errors. Open-ended comments included: "excellent", "very valuable", "just in time", "great practice", "timely", "we need more training like this", and "best day in medical school yet". Some did report they could allocate more time for practice.

# Discussion

EM-related competencies in medical school curricula may lack uniformity and standardization.[16] As such, it may not be surprising to see that significant variability exists in the basic

**Table 4** Objectives and stations for procedure workshop

| Procedure workshop station | Objectives<br>At the end of session, learner will be able to: |
|---|---|
| **Airway management**<br>Emergency medicine milestones<br>• Patient care (PC10) – airway management<br>• Patient care (PC9) – general approach to procedures | 1. List the indications for acute airway management<br>2. Identify equipment commonly used in airway management including: bag-valve masks, laryngoscopes, airway adjuncts, rescue equipment<br>3. Describe upper airway anatomy<br>4. List the steps necessary to prepare a patient for endotracheal intubation<br>5. Demonstrate proper technique for endotracheal intubate using direct laryngoscopy, video laryngoscopy, and boogie-assisted intubation<br>6. Confirm proper tube placement using multiple modalities<br>7. List the indications, risks, benefits, and alternatives for cricothyrotomy<br>8. Demonstrate appropriate preparation and technique to perform needle and surgical cricothyrotomy |
| **Breathing management**<br>Emergency medicine milestones<br>• Patient care (PC9) – general approach to procedures<br>• Patient care (PC10) – airway management | 1. List indications, risks, and benefits for tube thoracostomy<br>2. Demonstrate the proper preparation and technique for tube thoracostomy<br>3. Identify indications for thoracentesis<br>4. Demonstrate the proper preparation and technique for thoracentesis<br>5. Demonstrate proper technique to position a patient for bag-valve mask ventilation and endotracheal intubation |
| **Circulation management**<br>Emergency medicine milestones<br>• Patient care (PC9) – general approach to procedures<br>• Patient care (PC12) – goal-directed focused ultrasound<br>• Patient care (PC14) – vascular access | 1. Identify a patient in need of vascular access<br>2. Demonstrate successful placement of peripheral IV line with ultrasound<br>3. Identify a patient in need of central venous access<br>4. List the risks, benefits, and contraindications of central venous access at each of the sites: right internal jugular, right subclavian, and femoral veins<br>5. Demonstrate the proper preparation and technique for successful central venous access with and without ultrasound guidance (each of three sites)<br>6. List the indication, contraindications, risks, benefits, and alternatives to intraosseous catheter insertion<br>7. Demonstrate proper preparation and insertion of an intraosseous line |

**Abbreviation:** IV, intravenous.

knowledge and skills of incoming EM residents. The resulting gap in expected versus actual skill sets is of concern to educators, supervising clinicians, and the public. A standardized EM boot camp may help mitigate these deficiencies by developing specialty-specific competencies. Currently, there is no existing framework for the setting up of an EM boot camp. We looked to the EPAs, EM resident milestones, and competencies for guidance to inform the design of a proposed EM boot camp curriculum.[6,9]

Mapping the core EPAs to the EM milestone Level 1 competencies for the entering residents helped to: 1) determine that there likely exists a need for an EM-specific boot camp and 2) identify some of the specific gaps/needs to be addressed by the boot camp curriculum. Seven of the 23 EM-specific milestones did not map to the EPAs (Table 1). Five (PC 6, PC 10, PC 11, PC 12, and PC 13) of these seven are uniquely tied to EM practice. Since EPAs outline general competencies and are not discipline-specific, these gaps are not unexpected. Two competencies, PC 7 and PROF 2, are general and apply across disciplines, but did not map to a corresponding EPA. Admittedly, these are included in categories likely to be covered well in medical school, but there are specific issues unique to EM that fall under these domains. For example, patient disposition (PC 7) is integral to daily EM practice and therefore would need to be addressed.

Based on our mapping, it is clear that any proposed EM boot camp should, at a minimum, focus on the key gap areas related to EM, such as airway management, pain management, procedural sedation, ultrasound, and patient observation in the emergency department (ED), reassessment, and disposition. Practice and instruction – in the list of core procedures and clinical competencies – that we have identified here would also be beneficial. Finally, there is a need for reinforcement of general, but essential topics such as patient-centered communication and professionalism. For example, timely chart completion, duty hour reporting, and procedure logging (PROF 2) should be addressed in a proposed EM boot camp. A Professionalism in Residency session to address the development of the professional identity of trainees as EM physicians would be similarly beneficial.

We identified some supplemental topics based on a review of literature on surgery and EM-resident-aimed boot camps.[10–12] Topics include: advanced cardiac life support skills, medicolegal principles of ED patient care, how to place a patient on a cardiac monitor, work code cart monitors/defibrillators, and perform female genitourinary

examinations.[10,11] Advanced topics on orthopedics (splinting), ophthalmology (slit-lamp), and otolaryngology are relevant and may be considered, if time permits. Similarly, high-yield topics such as sepsis, stroke, and asthma may be reviewed to help students critically understand the current status and best practices.

It is important to note that boot camps themselves may be subject to variability and inconsistencies that may limit their generalizability across programs. Therefore, we propose a core standardized EM boot camp curriculum across schools to help optimize learning outcomes.

## Future perspectives

The focus areas identified based on the mapping of the core EPAs to the EM milestone, the list of conditions and procedures selected based on literature review, and the feedback obtained from the pilot procedure boot camp is guiding the design of a formal, for-credit, 2-week EM boot camp at our institution that will allow for adequate time to teach, practice, and assess skills. Since many schools cap the number of weeks a student can rotate with a specific department, we recommend that the boot camp be approved under the Office of Education or equivalent so that students are not forced to make difficult choices.

We plan a variety of educational modalities to deliver this proposed boot camp: lectures, podcasts, and videos for flipped classroom e-learning; small group discussions; procedure workshops; and simulations (manikin and standardized patients). Expected resources will include faculty/residents to facilitate, equipment, space, and a budget for supplies. Pre- and post-assessments of knowledge and skills, as well as direct observation, will assess the effectiveness of this curriculum.

## Conclusion

Mapping the Core EPAs for Entering Residency to the EM milestones at Level 1 identifies educational gaps for graduating medical students. Gaps include procedural skills such as airway management, procedural sedation, pain management, care of wounds, suturing, and emergency ultrasound, as well as ED-specific skills related to patient reassessment, observation, and disposition. Educators seeking to design EM boot camps for medical students should consider the identified gaps, procedures, and clinical conditions during the development of a core standardized curriculum.

## Disclosure

The authors report no conflicts of interest in this work.

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# Supplementary materials

**Table S1** Detailed mapping and comparison of Core Entrustable Professional Activity for Entering Residency vs ACGME milestones for Emergency Medicine residents[6,9]

| Overall competency | Milestone at Level 1 | Core EPA |
|---|---|---|
| PC1: Emergency stabilization<br>Prioritizes critical initial stabilization action and mobilizes hospital support services in the resuscitation of a critically ill or injured patient and reassesses after stabilizing intervention | Recognizes abnormal vital signs | EPA 10: Recognize a patient requiring urgent or emergent care and initiate evaluation and management |
| PC2: Performance of focused history and physical exam<br>Abstracts current findings in a patient with multiple chronic medical problems and, when appropriate, compares with a prior medical record and identifies significant differences between the current presentation and past presentations | Performs and communicates a reliable, comprehensive history and physical exam | EPA 1: Gather a history and perform a physical examination<br>EPA 6: Provide an oral presentation of a clinical encounter |
| PC3: Diagnostic studies<br>Applies the results of diagnostic testing based on the probability of disease and the likelihood of test results altering management | Determines the necessity of diagnostic studies | EPA 3: Recommend and interpret common diagnostic and screening tests |
| PC4: Diagnosis<br>Based on all available data, narrows and prioritizes the list of weighted differential diagnoses to determine appropriate management | Constructs a list of potential diagnoses based on chief complaint and initial assessment | EPA 2: Prioritize a differential diagnosis following a clinical encounter |
| PC5: Pharmacotherapy<br>Selects and prescribes appropriate pharmaceutical agents based upon relevant considerations such as mechanism of action, intended effect, financial considerations, possible adverse effects, patient preferences, allergies, potential drug–food and drug–drug interactions, institutional policies, and clinical guidelines | Knows the different classifications of pharmacologic agents and their mechanism of action. Consistently asks patient for drug allergies | EPA 4: Enter and discuss order and prescriptions |
| PC6: Observation and reassessment<br>Reevaluates patients undergoing ED observation (and monitoring) and using appropriate data and resources, determines the differential diagnosis, treatment plan, and disposition | Recognizes the need for patient reevaluation | None |
| PC7: Disposition<br>Establishes and implements a comprehensive disposition plan that uses appropriate consultation resources; patient education regarding diagnosis; treatment plan; medications; and time- and location-specific disposition instructions | Describes basic resources available for care of the emergency department patient | None |
| PC8: Multitasking (task-switching)<br>Employs task switching in an efficient and timely manner in order to manage the ED | Manages a single patient amidst distractions | EPA 10: Recognize a patient requiring urgent or emergent care and initiate evaluation and management |
| PC9: General approach to procedures<br>Performs the indicated procedure on all appropriate patients (including those who are uncooperative, at the extremes of age, hemodynamically unstable and those who have multiple comorbidities, poorly defined anatomy, high risk for pain or procedural complications, sedation requirement), takes steps to avoid potential complications, and recognizes the outcome and/or complications resulting from the procedure | Identifies pertinent anatomy and physiology for a specific procedure; uses appropriate universal precautions | EPA 11: Obtain informed consent for tests and/or procedures<br>EPA 12: Perform general procedures of a physician |
| PC10: Airway management<br>Performs airway management on all appropriate patients (including those who are uncooperative, at the extremes of age, hemodynamically unstable and those who have multiple comorbidities, poorly defined anatomy, high risk for pain or procedural complications, sedation requirement), takes steps to avoid potential complications, and recognize the outcome and/or complications resulting from the procedure | Describes upper airway anatomy;<br>Performs basic airway maneuvers or adjuncts (jaw thrust/chin lift/oral airway/nasopharyngeal airway) and ventilates/oxygenates patient using BVM | None |

(*Continued*)

**Table S1** (*Continued*)

| Overall competency | Milestone at Level 1 | Core EPA |
|---|---|---|
| PC11: Anesthesia and acute pain management<br>Provides safe acute pain management, anesthesia, and procedural sedation to patients of all ages regardless of the clinical situation | Discusses with the patient indications, contraindications, and possible complications of local anesthesia; performs local anesthesia using appropriate doses of local anesthetic and appropriate technique to provide skin to subdermal anesthesia for procedures | None |
| PC12: Other diagnostic and therapeutic procedures: goal-directed focused ultrasound (diagnostic/procedural)<br>Uses goal-directed focused ultrasound for the bedside diagnostic evaluation of emergency medical conditions and diagnoses, resuscitation of the acutely ill or injured patient, and procedural guidance | Describes the indications for emergency ultrasound | None |
| PC13: Other diagnostic and therapeutic procedures: wound management<br>Assesses and appropriately manages wounds in patients of all ages regardless of the clinical situation | Prepares a simple wound for suturing (identify appropriate suture material, anesthetize wound and irrigate); demonstrates sterile technique; places a simple interrupted suture | None |
| PC14: Other diagnostic and therapeutic procedures: vascular access<br>Successfully obtains vascular access in patients of all ages regardless of the clinical situation | Performs a venipuncture; places a peripheral intravenous line; performs an arterial puncture | EPA 12: Perform general procedures of a physician |
| MK: Medical knowledge<br>Demonstrates appropriate medical knowledge in the care of emergency medicine patients | Passes initial national licensing examinations (eg, USMLE Step 1 and Step 2 or COMLEX Level 1 and Level 2) | Not applicable |
| SBP1: Patient safety<br>Participates in performance improvement to optimize patient safety | Adheres to standards for maintenance of a safe working environment; describes medical errors and adverse events | EPA 13: Identify system failures and contribute to a culture of safety and improvement |
| SBP2: Systems-based management<br>Participates in strategies to improve health care delivery and flow. Demonstrates an awareness of and responsiveness to the larger context and system of health care | Describes members of ED team (eg, nurses, technicians, security) | EPA 13: Identify system failures and contribute to a culture of safety and improvement |
| SBP2: Technology<br>Uses technology to accomplish and document safe health care delivery | Uses the Electronic Health Record (EHR) to order tests, medications, and document notes, and respond to alerts; reviews medications for patients | EPA 5: Document a clinical encounter in the patient record |
| PBLI: Practice-based performance improvement<br>Participates in performance improvement to optimize ED function, self-learning, and patient care | Describes basic principles of evidence-based medicine | EPA 7: Form clinical questions and retrieve evidence to advance patient care |
| PROF1: Practice-based performance improvement<br>Participates in performance improvement to optimize ED function, self-learning, and patient care | Demonstrates behavior that conveys caring, honesty, genuine interest, and tolerance when interacting with a diverse population of patients and families | EPA 1: Gather a history and perform a physical examination |
| PROF2: Accountability<br>Demonstrates accountability to patients, society, profession, and self | Demonstrates basic professional responsibilities such as timely reporting for duty, appropriate dress/grooming, rested and ready to work, delivery of patient care as a functional physician; maintains patient confidentially; uses social media ethically and responsibly; adheres to professional responsibilities, such as conference attendance, timely chart completion, duty hour reporting, procedure reporting | None |

(*Continued*)

**Table S1** (*Continued*)

| Overall competency | Milestone at Level 1 | Core EPA |
|---|---|---|
| ICS1: Patient-centered communication<br>Demonstrates interpersonal and communication skills that result in the effective exchange of information and collaboration with patients and their families | Establishes rapport with and demonstrate empathy toward patients and their families; listens effectively to patients and their families | EPA 1: Gather a history and perform a physical examination |
| ICS2: Team management<br>Leads patient-centered care teams, ensuring effective communication and mutual respect among members of the team | Participates as a member of a patient care team | EPA 6: Provide an oral presentation of a clinical encounter<br>EPA 8: Give or receive a patient handover to transition care responsibility<br>EPA 9: Collaborate as a member of an interprofessional team |

**Abbreviations:** EPA, Entrustable Professional Activity; PC, patient care; MK, medical knowledge; SBP, systems-based practice; PBLI, practice-based performance improvement; PROF, professionalism; ICS, interpersonal and communication skills; ED, emergency department; BVM, bag-valve mask; ACGME, Accreditation Council for Graduate Medical Education; USMLE, United States Medical Licensing Examination; COMLEX, Comprehensive Osteopathic Medical Licensing Examination.

**Table S2** Intubation competency evaluation

| Critical actions | Requires verbal prompting with performance errors<br>0 | Works independently with minor performance errors<br>1 | Works independently without performance errors<br>2 |
|---|---|---|---|
| Consider the indication for intubation (Is positive airway pressure CPAP/BIPAP an option?) (do-not-intubate status; consent) | ☐ | ☐ | ☐ |
| Pre-oxygenate with high-flow oxygen (3 minutes or eight deep breaths) | ☐ | ☐ | ☐ |
| Assess for difficult laryngoscopy, difficult bag-valve mask, difficult supraglottic airway device | ☐ | ☐ | ☐ |
| If suspected difficult airway and time allows, consider awake technique and/or call for help | ☐ | ☐ | ☐ |
| Check for dentures | ☐ | ☐ | ☐ |
| Position patient (ramped/sniff) | ☐ | ☐ | ☐ |
| Continuous monitoring | ☐ | ☐ | ☐ |
| Start IV access (×2 preferably) | ☐ | ☐ | ☐ |
| Administer $O_2$ via nasal cannula for apneic oxygenation | ☐ | ☐ | ☐ |
| Set up equipment:<br>Bag-valve mask, naso/oropharygeal airway, suction, laryngoscope, blade, capnometer, endotracheal tube, stylet, adjuncts, difficult airway equipment | ☐ | ☐ | ☐ |
| Drugs (rapid sequence induction) | ☐ | ☐ | ☐ |
| Personnel | ☐ | ☐ | ☐ |
| Ventilator and settings | ☐ | ☐ | ☐ |
| Tube placement verification | ☐ | ☐ | ☐ |
| Secure endotracheal tube | ☐ | ☐ | ☐ |
| Verbalize response: "What are next steps to ensure a safe intubation?" | Sedation<br>☐ | CXR<br>☐ | Blood gas q30 minutes post-intubation<br>☐ |

**Abbreviations:** CPAP, continuous positive airway pressure; BIPAP, biphasic positive airway pressure; IV, intraveneous; CXR, chest X-ray.

**Table S3** The advanced ABCs: a residency preparatory workshop–post-workshop survey_____

Please complete this anonymous evaluation by assigning each statement a number corresponding to your opinion and placing a checkmark in the appropriate box. Your opinion matters and will assist us in developing quality instruction to improve educational and patient care outcomes. Thank you for taking the time to complete this form

| | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---|---|---|---|---|---|
| **Training environment** | | | | | |
| Was safe and nonthreatening | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Procedure workshop station(s)** | | | | | |
| Objectives were clearly defined | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were well organized | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were appropriately paced | ☐ | ☐ | ☐ | ☐ | ☐ |
| Met my goal and expectations | ☐ | ☐ | ☐ | ☐ | ☐ |
| The podcasts helped me prepare for the SIM session | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were appropriate for my level of training | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were appropriately paced | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Simulation and clinical equipment/supplies** | | | | | |
| Were adequate | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were realistic | ☐ | ☐ | ☐ | ☐ | ☐ |
| Added value to the learning experience | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Instructor(s)** | | | | | |
| Were knowledgeable about the subject | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were prepared to facilitate this activity | ☐ | ☐ | ☐ | ☐ | ☐ |
| Facilitated in a way that helped me learn | ☐ | ☐ | ☐ | ☐ | ☐ |
| Encouraged participation and collaboration | ☐ | ☐ | ☐ | ☐ | ☐ |
| Were enthusiastic about this activity | ☐ | ☐ | ☐ | ☐ | ☐ |
| Encouraged learner's questions | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Learner(s) – "After the procedure workshop[…]"** | | | | | |
| I am more familiar with the indications/contraindications/complications/technique and equipment associated with: | | | | | |
| Bag-valve mask ventilation | ☐ | ☐ | ☐ | ☐ | ☐ |
| Naso/oropharyngeal airway | ☐ | ☐ | ☐ | ☐ | ☐ |
| Direct laryngoscopy | ☐ | ☐ | ☐ | ☐ | ☐ |
| Laryngeal mask airway | ☐ | ☐ | ☐ | ☐ | ☐ |
| Bougie | ☐ | ☐ | ☐ | ☐ | ☐ |
| Video laryngoscopy | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cricothyrotomy | ☐ | ☐ | ☐ | ☐ | ☐ |
| Thoracostomy | ☐ | ☐ | ☐ | ☐ | ☐ |
| Thoracentesis | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ultrasound-guided central line cannulation | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ultrasound-guided peripheral line insertion | ☐ | ☐ | ☐ | ☐ | ☐ |
| I have more knowledge | ☐ | ☐ | ☐ | ☐ | ☐ |
| I feel more confident | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Overall SIM-based workshop experience** | | | | | |
| The workshop met my goals and expectations | ☐ | ☐ | ☐ | ☐ | ☐ |
| I enjoyed the procedure workshop | ☐ | ☐ | ☐ | ☐ | ☐ |
| I want more opportunities to learn using simulation | ☐ | ☐ | ☐ | ☐ | ☐ |
| I would recommend this teaching tool to others | ☐ | ☐ | ☐ | ☐ | ☐ |

**Comments:**