A Multicenter Collaboration for Simulation-Based Assessment of ACGME Milestones in Emergency Medicine

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Summary Statement: In 2014, the six allopathic emergency medicine (EM) residency programs in Chicago established an annual, citywide, simulation-based assessment of all postgraduate year 2 EM residents. The cases and corresponding assessment tools were designed by the simulation directors from each of the participating sites. All assessment tools include critical actions that map directly to numerous EM milestones in 11 different subcompetencies. The 2-hour assessments provide opportunities for residents to lead resuscitations of critically ill patients and demonstrate procedural skills, using mannequins and task trainers respectively. More than 80 residents participate annually and their assessment experiences are essentially identical across testing sites. The assessments are completed electronically and comparative performance data are immediately available to program directors.
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In 2013, the Accreditation Council for Graduate Medical Education (ACGME) introduced competency-based developmental milestones to supplement the assessment of the ACGME Core Competencies. Milestones provide a framework to assess resident and fellow competence by linking knowledge, skills, attitudes, and other measurable attributes to specific levels of learner achievement.[1] Each specialty was given the opportunity to develop their own milestones via working groups.[2] Emergency medicine (EM) was one of the early adopters of the milestones and the Next Accreditation System,[3] creating and validating a total of 227 milestones across 23 subcompetencies.[4,5]

Individual residency programs have flexibility to develop their own methods of assessment for each of the milestones, and levels are best assigned using multiple modalities,[6] including end-of-shift evaluations, direct observation, and simulation.[2] An ideal assessment tool allows for feedback to the resident, highlighting areas of successful performance, as well as those that need improvement.[7] However, residency programs encountered challenges with the implementation of milestone assessment, facing a lack of available standardized assessment instruments,[8] grade inflation,[9] and inaccurately high resident self-assessment of performance.[10] High-fidelity simulation has been identified as a tool that can be used to overcome these challenges and provide highly structured assessments in an efficient manner.[11] However, program directors may lack the resources necessary to conduct high-quality, reliable, multimodal performance assessments using simulation, because individual institutional resources are often inadequate for instrument development and testing, standard setting, faculty training, and statistical analysis of large data sets.

In 2014, the residency program directors of the six allopathic EM training programs in Chicago, Illinois, agreed to pool their local resources and work with their simulation center faculty members to create an annual, citywide, simulation-based assessment of numerous EM milestones. This report describes the efforts to establish this unique, collaborative assessment program (Table 1).

METHODS

Assessment Program Development

The goal of this project was to develop a simulation-based assessment of numerous EM Milestones for residents at the midpoint of their second year of training. Simulation faculty

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TABLE 1. Participating EM Residency Programs

Participating EM Residency Programs
Advocate Christ Medical Center
Cook County Hospital (Stroger)
Northwestern University
Presence Resurrection Medical Center
University of Illinois at Chicago
University of Chicago

members at each of the participating sites collaborated together as a program planning committee. This ten-person committee consisted of board-certified or board-eligible EM physicians and contained representatives from all Chicago EM residency programs (Table 1). During the first meeting, the committee members individually reviewed the EM milestones for appropriateness of potential assessment using simulation. Subcompetencies with full agreement for inclusion by all committee members were included. Subcompetencies without uniform agreement were discussed further until consensus had been achieved for inclusion or exclusion. Ultimately, 11 subcompetencies appropriate for the assessment of a postgraduate year (PGY) 2 resident using simulation were selected. Next, the committee identified milestones within each subcompetency that corresponded to the skill level anticipated for a mid-year PGY 2 resident. Again, each committee member identified milestones within the selected subcompetencies for inclusion in the assessment. Milestones with full agreement for inclusion by all committee members were included. Milestones without uniform agreement were discussed further until consensus had been achieved for inclusion or exclusion. These milestones provided the foundation for development of the simulation scenarios and related assessment tools (Table 2). Upon agreement of subcompetencies and milestones, the committee discussed what types of simulation modalities would be best suited to assess the resident's performance on the various milestones. This discussion included the use of task trainers, standardized patients, and mannequin-based scenarios. Ultimately, four scenarios were developed: two high-fidelity mannequin-based simulation cases and two task trainer-based simulation cases.

After determining the specific patient scenarios and procedures to be assessed, the committee drafted a standard outline for case development for the high-fidelity simulation assessments, including the initial presenting stems, transition points, responses to management decisions, and the ultimate disposition decisions necessary to conclude the scenarios. We used a similar approach to standardize the task trainer-based procedure scenarios, including the development of short stems to provide context for the procedures, as well as laboratory and radiology prompts to indicate the need to perform the procedures. To illustrate this process, one case involved a 35-year-old patient presenting with a severe asthma exacerbation. In this example, the patient is initially hypoxic and in respiratory distress. The patient's symptoms do not improve with continuous beta agonists and intravenous medications. Eventually the patient requires intubation for altered mental status and exhaustion. The committee adapted the wording of pertinent milestones into checklist items (Table 3) that could be observed while the residents were engaged in the simulation cases.

Assessment Tool Development

The committee developed assessment tools for the high-fidelity simulation cases by mapping EM milestones to checklist items for each case, as shown in the example in Table 3. For the procedure scenarios, checklists were created by combining existing assessment tools used for simulation-based procedure training at the programs in the study group. The committee reached consensus for the final versions of each assessment tool through a modified Delphi technique.

All checklist items were scored on a binary "performed" or "not performed" scale. The checklist for each station contained 20 to 35 items. Descriptions of correct performance as well as example prompts were embedded in the checklists to reduce variability in rater interpretation of checklist items. Several checklist items were designed in conjunction with specific scripting and prompting during the simulation scenario to allow for medical knowledge components to be assessed. As an example, for the checklist item corresponding to mechanism of action of a medication, the nurse in the room was prompted to ask the resident to briefly explain how the medication worked. An optional comment box was included to allow for specific individual feedback for each resident. After the first year of implementation, an additional overall global performance score was added to each scenario using a 1 to 10 scale; a score of "5" indicated that the resident had performed at their expected level of training as a PGY 2 resident.

All performance data were collected using the online platform Qualtrics (http://www.qualtrics.com; Provo, UT). Program directors received a score report containing performance data for each individual resident in their program. Score reports (Fig. 1) included individual resident performance for each checklist item. In addition, each individual checklist item included the corresponding mean program performance and citywide performance. As a summary component of each scenario score report, the mean overall global performance score for the individual with the corresponding mean scores for the learner's program and citywide performance were included with the optional rater comments.

Logistics

The assessment program has been conducted annually since 2014 during a 2-day testing period in February that is mutually convenient for all participating sites. The six programs are divided into pairs, based on equivalent residency class sizes. This pairing allows residents from one program to be assessed by faculty members in a different program, reducing bias in the assessments. Generally, residents travel to simulation centers at other programs, allowing faculty members to remain at their home institutions on testing days.

A testing schedule was developed based on the anticipated amount of time required to observe each of the four case scenarios, provide immediate debriefing and direct feedback, and reset the rooms for the next round of cases. Residents rotated through each of the four case scenarios. The complete rotation schedule required four faculty members to assess four residents in the four scenarios (1 faculty rater per resident per scenario) for a 2-hour period, with 20 minutes for the assessment, 5 minutes for debriefing, and 5 minutes to reset the simulators for the next assessment. In total, four faculty could assess 16 residents in an 8-hour day.

TABLE 2. The Selected Milestones Used in This Assessment With the Corresponding ACGME[1] Competency and Subcompetencies

Competency	Subcompetency	Selected Milestones
Patient Care	1. Emergency Stabilization (PC1) 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 • Recognizes when a patient is unstable requiring immediate intervention • Performs a primary assessment on a critically ill or injured patient • Prioritizes critical initial stabilization actions in the resuscitation of a critically ill or injured patient • Reassesses after implementing a stabilizing intervention
	2. Performance of Focused History and Physical Examination (PC2) 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.	• Prioritizes essential components of a history given a limited or dynamic circumstance • Prioritizes essential components of a physical examination given a limited or dynamic circumstance
	5. Pharmacotherapy (PC5) 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; and effectively combines agents and monitors and intervenes in the advent of adverse effects in the ED.	• Knows the different classifications of pharmacologic agents and their mechanism of action. • Consistently asks patients for drug allergies • Applies medical knowledge for selection of appropriate agent for therapeutic intervention • Considers array of drug therapy for treatment. Selects appropriate agent based on mechanism of action, intended effect, and anticipates potential adverse side effects
	9. General Approach to Procedures (PC9) 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 • Performs patient assessment, obtains informed consent and ensures monitoring equipment is in place in accordance with patient safety standards • Knows indications, contraindications, anatomic landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures • Performs the indicated common procedure on a patient with moderate urgency who has identifiable landmarks and a low-moderate risk for complications • Performs postprocedural assessment and identifies any potential complications
	10. Airway Management (PC10) 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.	• Performs basic airway maneuvers or adjuncts (jaw thrust/chin lift/oral airway/nasopharyngeal airway) and ventilates/oxygenates patient using BVM • Describes the pharmacology of agents used for rapid sequence intubation including specific indications and contraindications • Performs rapid sequence intubation in patients without adjuncts • Confirms proper endotracheal tube placement using multiple modalities • Implements postintubation management • Employs appropriate methods of mechanical ventilation based on specific patient physiology
	11. Anesthesia and Acute Pain Management (PC11) Provides safe acute pain management, anesthesia, and procedural sedation to patients of all ages regardless of the clinical situation.	• Knows the indications, contraindications, potential complications and appropriate doses of medications used for procedural sedation •Performs patient assessment and discusses with the patient the most appropriate analgesic/sedative medication and administers in the most appropriate dose and route
	14. Other Diagnostic and Therapeutic Procedures: Vascular Access (PC14) Successfully obtains vascular access in patients of all ages regardless of the clinical situation.	• Assesses the indications in conjunction with the patient anatomy/pathophysiology and select the optimal site for a central venous catheter • Inserts a central venous catheter using ultrasound and universal precautions • Confirms appropriate placement of central venous catheter
Systems-Based Practice	16. Patient Safety (SBP1) Participates in performance improvement to optimize patient safety.	• Adheres to standards for maintenance of a safe working environment • Routinely uses basic patient safety practices, such as timeouts and 'calls for help'
	17. Systems-based Management (SBP2) Participates in strategies to improve healthcare delivery and flow. Demonstrates an awareness of and responsiveness to the larger context and system of health care.	• Mobilizes institutional resources to assist in patient care

TABLE 2. *(Continued)*

Competency	Subcompetency	Selected Milestones
Interpersonal Skills and Communication	22. Patient-Centered Communication (ICS1) 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 • Elicits patients' reasons for seeking health care and expectations from the ED visit • Manages the expectations of those who receive care in the ED and uses communication methods that minimize the potential for stress, conflict, and misunderstanding
	23. Team Management (ICS2) Leads patient-centered care teams, ensuring effective communication and mutual respect among members of the team.	• Communicates pertinent information to emergency physicians and other healthcare colleagues • Ensures transitions of care are accurately and efficiently communicated

ED indicates emergency department; BVM, bag valve mask.

All high-fidelity mannequin-based scenarios were preprogrammed at each testing site using Laerdal LLEAP software (Laerdal Medical Corporation, Wappinger Falls, NY). Detailed faculty rater guides were distributed to the various sites to ensure adherence to the flow of each case. Faculty raters received their cases and assessment instruments before the event and then received a 1-hour orientation by individual site directors on the day of the assessments. Upon arrival to the testing site, the learners were provided a similar 15-minute orientation at each location. This scripted information explained the purpose of the assessment for milestone evaluation, explained that the results would be shared with their individual program directors, reviewed the schedule for the session, encouraged the learner to "think out loud," explained availability of consultant, and covered safety items including how to manage sharps at the end of procedure scenarios and safety with defibrillators.

For each procedure-based scenario, the faculty assessor completed the checklist while directly observing the learner perform the procedure. Nearly all faculty completed the checklist electronically at the time of the procedure, whereas a small minority completed a paper checklist that was then entered electronically after the assessment. The high-fidelity mannequin-based scenarios each required a total of three faculty or staff to implement. The first was an embedded nurse with knowledge of the scenario. The second was a simulation technologist who played the voice of the mannequin and controlled the preprogrammed responses to interventions in the scenario. The third was a faculty member positioned in the control room whose primary responsibility was the assessment of the resident performance and completion of the checklist. Additional responsibilities for this faculty member included serving as the consultant for any telephone conversations that occurred and providing feedback immediately after the assessment scenario.

DISCUSSION

To our knowledge, this is the first published description of a regional collaboration of residency training programs to assess ACGME EM Milestones using simulation. Since 2014, more than 300 second-year residents in the Chicago-area EM programs have been assessed in this project, with a participation rate of approximately 95%. This collaboration builds on the longstanding partnerships of our local EM programs, including the Illinois Statewide Mock Oral Boards course that has been coordinated by Cook County Hospital (Stroger) for almost 25 years. Therefore, our simulation-based milestone assessment program represents the second collaborative effort of our training programs that pools local institutional resources for testing purposes.

Residency program leaders face many training and accreditation challenges that might be overcome through program-level collaboration and shared resources. Regional research and educational conferences are common, though often coordinated by state or national organizations rather than local training programs. There are more than 20 geographic areas in the United States with at least two EM residency programs in close proximity. There are several examples of regional collaboration among EM programs, including successful conferences sponsored by *All NYC EM*[12] and *Greater Chesapeake Emergency Medicine*.[13] Additional groups outside of EM have also collaborated to develop regional multi-institutional simulation collaboratives. These programs have also leveraged the local expertise and have been designed to increase educational capacity in schools of nursing,[14] to increase accessibility and sustainability across statewide simulation programs,[15] and to improve access across multiple rural healthcare and educational institutions.[16] Based on these examples and our experience in Chicago, we are confident that similar regional partnerships can yield collaborative assessment programs, in addition to more traditional educational and research conferences.

Feedback about our assessment has been praised by residency program leadership that have indicated, "this is a wonderful project," "I absolutely love the way the results have been reported out," "this is great data and very helpful feedback for the residents," and "thank you very much for an outstanding education/evaluation event!" Importantly, our simulation-based assessments allow for feedback and teaching, in addition to the intended program goal of providing summative assessment data for milestone assignment. In addition to achieving the primary goal of providing summative feedback to the program leadership and learners, there may have been an added benefit of teaching and learning that occurred after each assessment scenario when residents

TABLE 3. Example Checklist of a High-Fidelity Simulation Case Mapped to EM Milestones[1]

Item	Subcompetency	Level	Milestone	Performance Anchor
1	22: Patient-Centered Communication (ICS1)	1	Establishes rapport with and demonstrate empathy toward patients and their families	Introduces self to patient (states physician name, role in care of patient - acceptable "I am Dr. Smith and I am the physician that will be caring for you today")
2	22: Patient-Centered Communication (ICS1)	2	Elicits patients' reasons for seeking health care and expectations from the ED visit	Elicits patient's reasons for seeking health care (eg, why did you come to the emergency department today?)
3	1: Emergency Stabilization (PC1)	1	Recognizes abnormal vital signs	Attaches patient to monitor (may do by self or request RN to perform task)
4	1: Emergency Stabilization (PC1)	1	Recognizes abnormal vital signs	Applies supplemental oxygen (may do by self or request RN to perform task)
5	1: Emergency Stabilization (PC1)	2	Performs a primary assessment on a critically ill or injured patient	Performs primary assessment on a critically ill patient including a brief HPI and examination (must include a pulmonary examination)
6	1: Emergency Stabilization (PC1) 5: Pharmacotherapy (PC5)	3 1	Prioritizes critical initial stabilization actions in the resuscitation of a critically ill or injured patient Knows the different classifications of pharmacologic agents and their mechanism of action	Administers initial duoneb (ipratropium/albuterol) for asthma exacerbation
7	1: Emergency Stabilization (PC1) 5: Pharmacotherapy (PC5)	3 1	Prioritizes critical initial stabilization actions in the resuscitation of a critically ill or injured patient Knows the different classifications of pharmacologic agents and their mechanism of action	Administers steroids (PO or IV) for asthma exacerbation
8	1: Emergency Stabilization (PC1) 5: Pharmacotherapy (PC5)	3 2	Reassess after implementing a stabilizing intervention Applies medical knowledge for selection of appropriate agent for therapeutic intervention	Orders magnesium 1–2 g IV
9	1: Emergency Stabilization (PC1) 5: Pharmacotherapy (PC5)	3 3	Reassess after implementing a stabilizing intervention Considers array of drug therapy for treatment. Selects appropriate agent based on mechanism of action, intended effect, and anticipates potential adverse side effects.	Verbalizes additional medications for severe asthma (terbutaline or epinephrine)
10	1: Emergency Stabilization (PC1)	3	Reassess after implementing a stabilizing intervention	Prepares for intubation when respiratory distress increases and medical management has failed to resolve symptoms
11	22: Patient-Centered Communication (ICS1)	3	Manages the expectations of those who receive care in the ED and uses communication methods that minimize the potential for stress, conflict, and misunderstanding	Informs patient of change in status and explains need for intubation
12	5: Pharmacotherapy (PC5) 10: Airway Management (PC10)	2 2	Applies medical knowledge for selection of appropriate agent for therapeutic intervention Describes the pharmacology of agents used for rapid sequence intubation including specific indications and contraindications	Selects appropriate RSI medications (must include a sedative and paralytic dosed appropriately - please comment below on choice of medications - ie, did they include ketamine for known bronchodilator effects)
13	9: General Approach to Procedures (PC9)	2	Knows indications, contraindications, anatomic, landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures	Appropriately positions the patient for intubation (sniffing position, towel roll as needed, head of bed at appropriate height for the person performing the intubation)
14	9: General Approach to Procedures (PC9)	2	Knows indications, contraindications, anatomic, landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures	Ensures required equipment for intubation is present and functional (laryngoscope blade, suction, back-up device, BVM, $ETCO_2$, oral/nasal airways)

TABLE 3. *(Continued)*

Item	Subcompetency	Level	Milestone	Performance Anchor
15	10: Airway Management (PC10)	1	Performs basic airway maneuvers or adjuncts (jaw thrust/chin lift/oral airway/nasopharyngeal airway) and ventilates/oxygenates using BVM	Preoxygenates patient (include in comments if high flow passive nasal cannula oxygen is used)
16	5: Pharmacotherapy (PC5)	3	Considers array of drug therapy for treatment. Selects appropriate agent based on mechanism of action, intended effect, and anticipates potential adverse side effects.	Administers RSI medications in correct order and dosage (sedative first, paralytic second)
17	10: Airway Management (PC10)	2	Perform rapid sequence intubation in patients without adjuncts	Perform RSI in patient without adjuncts
18	10: Airway Management (PC10)	3	Implements postintubation management	Implements postintubation management with confirmation of endotracheal tube placement (must use at least 3 of the following: verbalized tube passing through cords, end tidal CO_2, listen for bilateral breath sounds, absence of sounds of the stomach, CXR)
19	10: Airway Management (PC10)	3	Implements postintubation management	Implements postintubation management with administration of appropriate sedation after intubation
20	10: Airway Management (PC10)	3	Employs appropriate methods of mechanical ventilation based on specific patient physiology	Employs appropriate methods of mechanical ventilation based on specific patient physiology by verbalizing ventilators settings appropriate for asthma exacerbation (may prompt - "respiratory is here and wants to know the ventilator settings." Must contain 2 of the following: high flow rate, low respiratory rate, prolonged expiratory time, low PEEP, low tidal volumes)
21	23: Team Management (ICS2)	2	Communicates pertinent information to emergency physicians and other healthcare colleagues	Demonstrates effective communication by communicating pertinent information to other healthcare colleagues during the case (RN and consultants)
22	23: Team Management (ICS2)	3	Ensures transitions of care are accurately and efficiently communicated	Ensures transition of care to MICU is accurately and effectively communicated

Case example: 35-year-old patient presents to the emergency department with severe asthma exacerbation.
HPI indicates history of present illness; PO, by mouth; IV, intravenous; RSI, rapid sequence intubation; BVM, bag valve mask; ETCO2, end tidal carbon dioxide; CXR, chest x-ray; PEEP, positive end expiratory pressure; RN, registered nurse; MICU, medical intensive care unit.

Resident Name	Individual	Program	All Chicago Programs		
Item	Performed	% Performed	Performed	Not Performed	% Performed
1. Introduces self to patient (states physician name, role in care of patient - acceptable - "I am Dr. Smith and I am the physician that will be caring for you today) (22:1)	PERFORMED	88.9%	73	7	91.3%
2. Elicits patient's reasons for seeking health care (ex- why did you come to the emergency department today?) (22:2)	PERFORMED	100.0%	79	1	98.8%
3. Attaches patient to monitor (may do by self or request RN to perform task) (1:1)	PERFORMED	100.0%	78	2	97.5%
4. Applies supplemental oxygen (may do by self or request RN to perform task) (1:2)	PERFORMED	100.0%	79	1	98.8%
5. Performs primary assessment on a critically ill patient including a brief HPI and exam (must include a pulmonary exam) (1:2)	PERFORMED	100.0%	80	0	100.0%
6. Administers initial duoneb (ipratropium/albuterol) for asthma exacerbation (1:3, 5:2)	PERFORMED	100.0%	79	1	98.8%
7. Administers steroids (PO or IV) for asthma exacerbation (1:3, 5:2)	NOT PERFORMED	88.9%	76	4	95.0%
8. Orders magnesium 1-2g IV (1:4, 5:3)	NOT PERFORMED	66.7%	69	11	86.3%
9. Verbalizes additional medications for severe asthma (terbutaline or epinephrine) (1:4, 5:3)	PERFORMED	61.1%	43	37	53.8%
10. Prepares for intubation when respiratory distress increases and medical management has failed to resolve symptoms (1:4)	PERFORMED	100.0%	79	1	98.8%
11. Informs patient of change in status and explains need for intubation (22:3)	PERFORMED	94.4%	73	7	91.3%
12. Selects appropriate RSI medications (must include a sedative and paralytic dosed appropriately - please comment below on choice of medications - i.e. did they include ketamine for known bronchodilator effects) (5:2)	PERFORMED	94.4%	75	5	93.8%
13. Appropriately positions the patient for intubation (sniffing position, towel roll as needed, head of bed at appropriate height for the person performing the intubation) (10:1)	PERFORMED	100.0%	75	5	93.8%
14. Ensures required equipment for intubation is present and functional (laryngoscope blade, suction, back-up device, BVM, ETCO2, oral/nasal airways) (10:2)	PERFORMED	38.9%	64	16	80.0%
15. Pre-oxygenates patient (include in comments if high flow passive nasal cannula oxygen is used) (10:2)	NOT PERFORMED	38.9%	65	15	81.3%
16. Administers RSI medications in correct order and dosage (sedative first, paralytic second) (5:3)	PERFORMED	100.0%	76	4	95.0%
17. Perform RSI in patient without adjuncts (10:2)	PERFORMED	94.4%	79	1	98.8%
18. Implements post-intubation management with confirmation of endotracheal tube placement (must use at least 3 of the following: Verbalized tube passing through cords, end tidal CO2, Listen for bilateral breath sounds, absence of sounds over the stomach, CXR) (10:3)	PERFORMED	100.0%	74	6	92.5%
19. Implements post-intubation management with administration of appropriate sedation following intubation (10:3)	PERFORMED	66.7%	50	30	62.5%
20. Employs appropriate methods of mechanical ventilation based on specific patient physiology by verbalizing ventilator settings appropriate for asthma exacerbation (may prompt - "respiratory is here and wants to know the ventilator settings". Must contain 2 of the following: high flow rate, low respiratory rate, prolonged expiratory time, low PEEP, low tidal volumes) (10:3)	PERFORMED	22.2%	56	24	70.0%
21. Demonstrates effective communication by communicating pertinent information to other healthcare colleagues during the case (RN and consultants) (23:2)	PERFORMED	100.0%	79	1	98.8%
22. Ensures transition of care to MICU is accurately and effectively communicated (23:3)	PERFORMED	100.0%	80	0	100.0%

Overall Global Performance:
0 = Far below expectations
Rater #1 - 6

City Wide Average: 6.76
5 = At expectation for this level of training

Program Average: 6.39
10 = Greatly exceeds expectations

Comments
Rater Name
Rater Role: MD

Able to take an appropriately directed history. Good rapport with patient and nurse. Did do a trial of BiPAP. Reviewed labs, identified CO2 retention on blood gas. Was good about ordering sedation, and scheduling frequent nebs post intubation. Did not order a post-intubation CXR. / did not know dose of magnesium, did order it / used etomidate and succ-ketamine would have been preferred. Appropriate doses given. / Excellent use of back up blades, boogie, etc. / rate 12 prolonged exp phase PEEP 8 TV400 FIo2=100% --PEEP is too high, TV ok, good with prolonged expiratory phase but 12 breathes is borderline fast

FIGURE 1. Example score report for the asthma case with corresponding individual performance on checklist item, overall program performance, and performance across all participating programs. The score report also includes individual global performance rating with comparison with program and city wide mean scores and specific comments or explanations of ratings.

received immediate feedback from the faculty assessors. Residency leaders receive individual performance data for their trainees, norm-referenced to performance by residents at their partner institutions. Clinical competency committees at each participating site consider these important data when providing semiannual milestone assessments of their residents. Finally, simulation-based assessments provide a standardized approach to the evaluation of difficult to rate milestones, including those within the domains of procedural competency,[17] professionalism, and communications skills.

Although the assessment was developed to assess PGY 2 specific milestones, we recognized that we might have missed an opportunity to identify residents that were performing at an even higher level. This motivated the inclusion of the overall global performance score after the first year. Although this score did not map to any specific milestones, it did provide an additional performance metric that program leadership could use to inform progression through the milestones.

Several checklist items related to medical knowledge competencies. To assess the resident's medical knowledge underlying his or her decisions, nurse prompts were incorporated into the scenarios to encourage residents to verbalize their decision-making process. Although the authors attempted to minimize disruptions, this process may have inadvertently interrupted case flow at times. In this instance, simulation may serve as an additional adjunct in the overall assessment strategy for medical knowledge using traditional approaches[18] such as the in-training examination and resident-specific question banks.

Now entering our fifth year of the collaboration, residency directors have identified program specific trends in their data, allowing them to target performance deficiencies and enrich their curricular development. For instance, we have noted that across programs, residents often forget to demonstrate "hand washing" at the start of a simulation, do not voice "time-outs," and rarely offer alternatives to a procedure when obtaining informed consent.

This project has also promoted collegiality among programs in this region, with the unanticipated additional benefits of academic collaboration, networking, and optimal resource use. The pooling of citywide simulation resources and collaboration of simulation faculty allows for an innovative approach for the assessment of specific milestones. Although initial development was labor intensive, it has since required minimal administrative oversight each year.

Although this project has been very well received, we have faced a number of implementation challenges worth noting. Simulation is both time-consuming and resource intensive. Our programs had variable experience with the implementation of simulation curricula and individually lacked the local expertise to develop and sustain this rigorous program. Collaboration

and sharing of resources address much of this challenge, but faculty development was still required. Although we were able to achieve consensus for checklist and case development from faculty representing a spectrum of EM training program types and institutions, this process may have nonetheless been impacted by regional bias should other programs choose to adopt our assessment tool. We have not yet accurately measured the interrater reliability of our assessments because of the large number of additional faculty raters that would be required. While one approach would be to double score a random sampling of residents in real time, we suspect that other programs may face similar challenges in securing faculty availability to serve as additional raters. To overcome this challenge, improve standardization and reliability of the assessments, and address the potential variability associated with large numbers of raters across multiple sites, a set of videos could be developed to calibrate raters and ensure reliability of assessment data. Because this assessment focused specifically on the PGY 2 resident to allow time for meaningful performance improvement by program directors if necessary, we did not attempt to validate across multiple PGY years to see whether it is possible to determine the difference between training levels. Case development was also very time and labor intensive; therefore, we have administered the same high-fidelity cases and procedure assessments for the last 4 years. Although residents are prebriefed to maintain confidentiality, they may reveal the content of the cases to other trainees, allowing them to in turn prepare for the cases and procedures; this may limit the integrity of the assessment.

CONCLUSIONS

Regional collaboration by simulation center faculty and sharing of institutional resources is a feasible approach to developing efficient, high-quality, simulation-based assessments of residents across numerous ACGME Milestones. Though complex to initially develop and implement, this project has since yielded substantial benefit annually to our participating training programs. Based on the positive experiences of our regional partnership, we encourage the exploration of similar institutional collaborations elsewhere to innovate new assessment methods and programs.

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