Assessing Medical Decision Making Using Human Patient Simulation

Beth Anne Fox, MD, MPH

Background: *This pilot study describes an Objective Structured Clinical Examination (OSCE) developed using Human Patient Simulation (HPS).* Methods: *Eight residents completed two iterations of this HPS OSCE containing seven stations and utilizing checklists, global ratings, and scoring sheets.* Results: *The first- and second-year residents scored similarly with mean scores of 64/104 and 62/123, respectively. No statistical difference was noted between the resident scores.* Conclusions: *The HPS OSCE is feasible for small groups. A larger study will be needed to determine the effectiveness of this tool for evaluation.*

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Objective Structured Clinical Examinations (OSCEs), combined with standardized patients (SPs), are a standard evaluation method in medical education. However, the assessment of clinical competence, especially clinical decision making in emergency situations (eg, cardiovascular emergencies) cannot be realistically replicated using SPs. Traditional OSCEs cannot measure or assess how residents would perform in a real-life emergency patient care situation.

This study's purpose was to assess resident medical decision making and performance in one simulated emergency situation. We used Human Patient Simulation (HPS) in a single-case OSCE with seven stations. HPS is a computer-driven, anatomically correct mannequin that can be programmed to reflect normal and pathologic physiologic functioning. HPS can duplicate illness, chronic condition, or emergency situation; can respond to real-time virtual interventions; and can be customized to address specific needs.[1] HPS can prompt the learner to react to and reassess rapidly changing physiologic parameters such as blood pressure, pulse, and responses to treatment interventions.[2] For example, the simulator can be programmed to (1) respond to dosages, types, and delivery of different medications such as metoprolol, resulting in a lowering of blood pressure and slowing of the heart rate, (2) develop or present with arrhythmias such as ventricular fibrillation and respond to defibrillation with return of a viable heart rhythm, and (3) demonstrate effects of other interventions such as right main stem bronchus intubation with reduced breath sounds and impaired ventilation resulting in hypoxia and absent breath sounds. These interventions and responses cannot be duplicated in the traditional OSCE with standardized patients.

Anesthesia trainers use HPS to expose residents to emergent situations such as malignant hyperthermia and cardiac ischemia and in trauma surgical training to improve surgical and procedural skills, teamwork, and resuscitation skills.[3] Medical student educators use HPS for teaching physical examination skills[4] and advanced cardiac resuscitation skills.[5] A 2010 literature search revealed no articles describing real-time resident assessment in an emergency situation using clinical simulation in family medicine. In our study, we incorporated HPS in an OSCE to assess family medicine residents' clinical decision making in one emergency situation.

Methods

East Tennessee State University (ETSU) Kingsport Family Medicine Residency is a 6-6-6 community-based residency. In the spring of 2008, we designed, implemented, and evaluated a pilot intervention integrating the HPS into an OSCE setting. We conducted two HPS OSCE sessions, one 3-hour session with three postgraduate year (PGY)-1 residents and another 6-hour session with five PGY-2 residents. Scheduling conflicts and patient care responsibilities prevented all 12 residents from participating. We adapted a traditional OSCE demonstrating acute coronary syndrome for use in this HPS OSCE. We purchased 9 hours of mannequin time at $50 per hour from the university. The mannequin was presented as

From the Department of Family Medicine, East Tennessee State University.

a patient lying on an emergency room bed. Her voice was provided by an actor (at a cost of $17 per hour) so she could respond to residents' questions in real time. The structure and content of the seven OSCE stations are described in Table 1, along with the Accreditation Council for Graduate Medical Education (ACGME) competency each was designed to measure. Two family medicine and one behavioral medicine faculty observed each session and timed and scored the stations. The Institutional Review Board of ETSU granted the study exempt status.

Testing and Scoring

In the traditional OSCE, checklists and global rating scales provide the basis for objective evaluation.[6-8] We used checklists and global rating scales for stations 1–4. The electrocardiogram interpretation in station 6 was independently scored by family medicine faculty. Family medicine faculty observing the OSCE developed a narrative report of each resident's performance and debriefed the resident at Station 7. The debriefing session addressed outcome results, process considerations, HPS interventions, differential diagnosis explanations, ECG interpretation, and overall performance. Additional information obtained from the resident during debriefing, such as clinical decision making and generation of differential diagnoses, was incorporated into the narrative report.

Data Analysis and Results

Descriptive and group statistics were compiled from the checklists and global rating forms used at the stations. Measures of central tendency were calculated for five OSCE stations as well as an overall score. For stations 1–4 and 6, the maximum score was 106 for PGY-1 and 123 for PGY 2. The physical examination checklist was piloted only in the second iteration. An independent *t* test was conducted to evaluate differences in PGY scores. There was no significant difference between the PGY-1 and PGY-2 residents at any of the five stations (t=.106, P=.92). OSCE Station means were: focused history 20 versus 15, differential diagnoses 4.3 versus 3.6, assessment and plan 3 versus 3.9, ECG interpretation 39 versus 41.6, for PGY-1 and PGY-2 groups respectively. The overall range for PGY-1 was 39.0–86.5 (mean=66.7, SD=24.7). The range for PGY-2 was 23.0–90.5 (mean=64.7, SD=25.6).

Table 1

Human Patient Simulator OSCE Station Description

OSCE Station	*Resident Task*	*Assessment Method*	*Time*	*Competncy Assessed*
1	Perform a focused history based on chief complaint.	Checklist of history components from direct faculty observation	7 minutes	PC, MK, ICS
2	Generate five differential diagnoses based on history, with the prioritization of each diagnosis.	Global rating scale	5 minutes	PC, MK
3	Perform a focused physical examination on the simulator (as it demonstrates physiologic and physical signs consistent with the presentation)	Checklist of physical examination components from direct faculty observation	4 minutes	PC, MK
4	Review, reevaluate, and reprioritize the differential diagnoses generated in station 2	Global rating scale	5 minutes	PC, MK
5	Return to human simulator. Continue to assess, evaluate, and intervene until diagnosis made. Use of print and electronic resources permitted. (Simulator programmed to respond with normal human physiology to therapeutic interventions. If acute coronary syndrome not recognized, simulator programmed to deteriorate into ventricular fibrillation.)	Direct faculty observation	20–30 minutes	PC, MK, ICS, PBL
6	After the scenario, resident provides a written explanation of the working diagnosis, with justification of the medical interventions, including electrocardiogram interpretation.	Faculty analysis of written explanation	20 minutes	MK
7	Debriefing	Faculty discussion and feedback	30 minutes	

OSCE—Objective Structured Clinical Examination
* Competency: PC—patient care, MK—medical knowledge, ICS—interpersonal and communication skills, PBL—practice-based learning and pmprovement

Discussion/Conclusions

This article describes the first documented OSCE with the Human Patient Simulator involving family medicine residents. We determined the HPS OSCE to be practical, useful, and feasible for small groups. There were no statistical differences observed between the two resident groups. However, the study is limited by a small number of subjects in a single institution, and we cannot generalize our findings from this pilot session. We only presented a single cardiac case, and our residents may have performed better in another case. A single case in 8 to 10 simulation sessions and repeated in one or two simulations in a larger OSCE with SPs would provide more comparative data of residence performance.

We were disappointed by the low scores of both classes of residents. Either the residents did not know the material, did not know how to locate and search resources for information, or knew the material but this pilot intervention did not capture their abilities. However, we did identify deficiencies in our curriculum and faculty teaching. We changed our curriculum and faculty teaching styles as a result of this pilot study. The HPS OSCE may provide an objective means of assessment and evaluation in the core competencies and identify deficiencies in knowledge, clinical skills, and clinical decision making in individual residents for remediation planning. We also recommend the HPS OSCE as a method for curriculum evaluation and faculty development.

Corresponding Author: Address correspondence to Dr Fox, East Tennessee State University, Department of Family Medicine, 201 Cassel Drive, Kingsport, TN 37660. 423-245-9623. Fax: 423-245-9631. foxba@etsu.edu.

References

1. Binstadt ES, Walls RM, White BA, et al. A comprehensive medical simulation education curriculum for emergency medicine residents. Ann Emerg Med 2007;49:495-504.
2. Lighthall GK, Barr J. The use of clinical simulation systems to train critical care physicians. J Intensive Care Med 2007;22:257-69.
3. Hatala R, Issenberg SB, Kassen B, Cole G, Bacchus CM, Scalese RJ. Assessing cardiac physical examination skills using simulation technology and real patients: a comparison study. Med Educ 2008;42:628-36.
4. Cooper JB, Taqueti VR. A brief history of the development of mannequin simulators for clinical education and training. Qual Saf Health Care 2004;13:111-18.
5. Tuggy ML. Virtual reality flexible sigmoidoscopy simulator training: impact on resident performance. J Am Board Fam Pract 1998;11(6):426-33.
6. Regehr G, MacRae H, Reznick RK, Szalay D. Comparing the psychometric properties of checklists and global rating scales for assessing performance on an OSCE-format examination. Acad Med 1998;73(9):993-7.
7. Friedlich M, MacRae H, Oandasan I, et al. Structured assessment of minor surgical skills (SAMSS) for family medicine residents. Acad Med 2001;76(12):1241-6.
8. Turner JL, Dankoski ME. Objective structured clinical exams: a critical review. Fam Med 2008;40(8):574-8.

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