Interdepartmental Collaboration for Simulation-based Education: Obstetric Emergencies for Emergency Medicine

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ABSTRACT

BACKGROUND: Simulation in medical education is a well-accepted educational modality that allows for practice of high risk, low frequency events. The Obstetric Emergencies for Emergency Medicine course was developed to prepare trainees for challenging scenarios.

METHODS: Six clinical scenarios were chosen: spontaneous vaginal delivery, neonatal resuscitation, preeclampsia, neonatal resuscitation with cardiopulmonary resuscitation (CPR), shoulder dystocia and postpartum hemorrhage. Development and facilitation was an interdepartmental effort with contributions from Emergency Medicine, Obstetrics and Gynecology, and Pediatric Emergency Medicine. Each case was allotted 35 minutes, including debriefing. Participants completed an evaluation survey for each scenario.

RESULTS: All participants responded yes to the question "Would you recommend this simulation become part of the standard curriculum." The means of ratings for "scenario overall" and "relevance to training/duties" ranged from 4.95-5 out of 5 across all simulation groups.

CONCLUSION: An interdepartmental and collaborative approach can optimize the success of a simulation educational program.

KEYWORDS: medical education, simulation, obstetric emergencies, neonatal emergencies

INTRODUCTION

The use of simulation for training was first reported in the aviation industry in 1929 when a basic flight simulator was developed, and has since become an important tool for educating healthcare providers. The first human patient simulator was created in 1966 as a method to train anesthesiology residents in endotracheal intubation. Over the past 20 years, simulation has become increasingly utilized across healthcare and thoroughly researched as a method to educate learners in procedural skills, teamwork, communication, and critical thinking.[1,2] It is uniquely suited to train individuals and teams in the assessment and management of low frequency, high acuity events in a safe setting, allowing practice without direct patient contact. With the use of high-fidelity simulators, healthcare providers can experience real-time feedback on their decisions and interventions in the form of changes in patient responsiveness, respiratory effort, and vital signs. Recently, there is growing evidence that training with simulation for procedures, such as for ultrasound-guided central line placement, can not only improve success rates but can also improve quality of care for patients.[3,4]

The Rhode Island Hospital Medical Simulation Center began operation in May 2002 and was created in part with funding from a United States Department of Defense project aimed at transferring the lessons learned from Army aviation to medical teams working in emergency departments. [5] The center was renamed the Lifespan Medical Simulation Center in 2012 and has become nationally recognized for innovative acute care simulations, teamwork training expertise, continuing medical education courses, and quality improvement programs ranging from office-based preparedness sessions to EMS training and inpatient interprofessional simulations. It is located one-third of a mile from the main Rhode Island Hospital/Hasbro Children's Hospital campus and blocks away from The Warren Alpert Medical School of Brown University, in the newly evolving "knowledge district" of Providence.

The delivery of a newborn in the emergency department is an uncommon, but potentially life-threatening emergency that emergency providers are expected to manage. The Accreditation Council for Graduate Medical Education (ACGME) states that the required training for an Emergency Medicine resident is 10 vaginal deliveries by the end of their training. There are no specific requirements stated for complicated deliveries. Resident training experiences in the clinical setting vary and, therefore, some standardization of educational experiences in this area is beneficial to ensure adequate and comprehensive training.

The Obstetrics Emergencies for Emergency Medicine course is one part of the larger Emergency Medicine (EM) resident simulation curriculum for Brown EM residents hosted at the Lifespan Medical Simulation Center. This curriculum is designed to provide training around high risk, low frequency events that EM trainees must be capable of handling upon graduation. It incorporates both tactile procedural skills, clinical decision making, and leadership skills.

The Brown EM residents have 5 hours per month of this simulation-based educational training as part of their standard curriculum.

METHODS

Curriculum

The goal of the Obstetrics Emergencies for Emergency Medicine course is to prepare EM residents for time-sensitive obstetric emergencies when immediate assistance from consultants is not available. The obstetric emergencies curriculum was designed specifically for EM providers. Cases were written and developed by simulation trained EM and Pediatric Emergency Medicine (PEM) faculty in collaboration with faculty from the department of Obstetrics and Gynecology (OB-GYN), who served as subject matter experts. The case scenarios developed represent low frequency, emergent and time-sensitive patient presentations.

Six clinical scenarios were chosen as simulation cases: normal spontaneous vaginal delivery, neonatal resuscitation, pre-eclamptic seizure, neonatal resuscitation with CPR, shoulder dystocia, and postpartum hemorrhage. Each case was developed with specific learning objectives and critical actions pertaining to the appropriate medical management of the clinical presentation.

The Obstetrical Emergencies for Emergency Medicine course was incorporated into the monthly EM resident simulation curriculum as a dedicated obstetrical simulation session. The total time for the session was approximately five hours including a brief introduction and a concluding meta-debriefing. Residents were divided into three groups of roughly ten participants. Each case was allotted a total of 35 minutes with approximately 20 minutes designated for the scenario followed by 15 minutes for debriefing. To successfully implement this simulation-based curriculum, the right mix of people, technology, and resources was required.

People

The Obstetrics Emergencies for Emergency Medicine team was multidisciplinary and interdepartmental, composed of subject matter experts, medical education and simulation experts, and simulation operations specialists. Our medical experts included two obstetricians, two pediatricians (specializing in pediatric emergency medicine and certified in neonatal resuscitation) and four emergency medicine physicians. This team of content experts worked together to ensure that the cases presented had sound medical knowledge and were realistic to those encountered in patient care. The medical education and simulation experts worked with the subject matter experts to write cases with clear goals and learning objectives including structured debriefing guides. Other team members critical for success included two simulation operations specialists. These individuals worked with the team to develop this high-fidelity simulation program, prepared the simulation environment for realistic staging of the cases, and directed control room activities of the manikins and audio-visual equipment during the course.

Technology

Technology based simulators enhance the educational experience by adding realism and real-time feedback to learners. The PROMPT Flex Advanced Birthing Simulator™ was used for the normal delivery and shoulder dystocia scenarios. The simulator comes with a fully articulating neonate with a flexible head and clavicles and an accompanying placenta with detachable umbilical cord to provide realism for the delivery. It is ideally suited to simulate shoulder dystocia because of the articulating hips and flexible vaginal wall and perineum which allows learners to perform standard maneuvers such as McRobert's, Zavanelli & posterior arm delivery. The neonate is Bluetooth-enabled so the instructor can monitor force applied to the baby during management of a shoulder dystocia.

For the neonatal resuscitation cases, Laerdal Sim NewB® was used. (**Figure 1**) This simulator responds to provider actions by changing vital signs, breath sounds, and pulses. Procedures including CPR, intubation, and umbilical vein catheterization can be performed. A similar adult version, Laerdal SimMan 3G®, was used for the postpartum hemorrhage case. While not a specific OB simulator, this simulator allows the focus of the case to be on resuscitation of the postpartum mother. Like Sim NewB®, this simulator responds

Figure 1. Sim NewB®

Sim NewB®, a life-sized anatomical manikin manufactured by Laerdal, allows medical students and residents along with providers to practice early assessment, diagnosis, and intervention in the Lifespan Medical Simulation Center.

[PHOTO COURTESY OF ALAN SOUSA, LIFESPAN MEDICAL SIMULATION SPECIALIST]

to provider actions and allows for multiple procedures related to resuscitation including IV insertion, intubation and intraosseous line placement.

For the pre-eclamptic seizure case, a standardized patient (SP) was used. While use of an SP is low technology, it allows for high fidelity regarding patient interviewing and changes in mental status. An earpiece allowed faculty to coach the standardized patient from the control room as necessary.

Indeed, other simulator options exist from a variety of manufacturers. There are some low technology wearable models that provide basic feedback, consisting of a rudimentary outlet to serve as a vagina and an inflatable neonate for delivery. Conversely, there are more expensive models that can provide even more sophisticated feedback. Such features include assessing fetal head position relative to the pelvis, information on progress of birth, medication administration to progress delivery, and incorporated software to provide the learner tocography and partograms. However, the specific simulators used worked well to meet our educational objectives and demonstrate a variety of options and technology available.

Evaluation

Participants were asked to evaluate each scenario they participated in during the course using the standard simulation evaluation form EM residents routinely complete after participating in simulation training exercises at the Lifespan Medical Simulation Center. Participants rated the simulation experience across three domains and space for free text comments was provided. This evaluation form was administered through Qualtrics® using a mobile friendly format to collect the anonymous responses.

RESULTS

Participants in the simulations included EM residents, advanced practice providers, medical students, and faculty. The largest participant category was residents with 16 (84.21%) attending the shoulder dystocia simulation, 12 (70.59%) attending the normal vaginal delivery simulation, 15 (83.33%) attending the postpartum hemorrhage simulation, 11 (73.33%) attending the preeclampsia simulation, 15 (78.95%) attending the neonatal resuscitation, and 15 (78.95%) attending the neonatal resuscitation with CPR simulation. One advanced practice provider, one medical student, and one faculty member participated in each simulation with the exception of the normal vaginal delivery simulation that had 3 faculty participants; the preeclampsia simulation that had two medical student participants, and both neonatal resuscitation simulations had two faculty participants.

Table 1. Participant feedback by scenario. Scale from 1 "Poor" to 5 "Excellent". Std dev =Standard deviation

Scenario		Scenario Overall	Relevance to training/ Duties Mean	Faculty effectiveness at facilitation and debriefing
Spontaneous vaginal delivery (n=17)	Min, Max	5, 5	5, 5	5, 5
	Mean (Std dev)	5 (0.00)	5 (0.00)	5 (0.00)
Shoulder dystocia (n=19)	Min, Max	5, 5	4, 5	4, 5
	Mean (Std dev)	5 (0.00)	4.95 (0.22)	4.95 (0.22)
Neonatal resuscitation (n=15)	Min, Max	4, 5	4, 5	4, 5
	Mean (Std dev)	4.87 (0.34)	4.93 (0.25)	4.87 (0.34)
Neonatal resuscitation with CPR (n=19)	Min, Max	4, 5	4, 5	4, 5
	Mean (Std dev)	4.95 (0.22)	4.95 (0.22)	4.95 (0.22)
Pre-eclamptic seizure (n=15)	Min, Max	5, 5	5, 5	4, 5
	Mean (Std dev)	5 (0.00)	5 (0.00)	4.93 (0.25)
Post-partum hemorrhage (n=18)	Min, Max	5, 5	5, 5	5, 5
	Mean (Std dev)	5 (0.00)	5 (0.00)	5 (0.00)

Across the six simulations, all participants agreed with the statement that "Learning objectives for this simulation were clearly identified" and responded yes to the question "Would you recommend this simulation become part of the standard curriculum?"

At the end of the simulation, participants were asked to rate the simulation in three categories (scenario overall, relevance to training/duties, and faculty effectiveness at facilitation and debriefing) using a scale from 1 to 5 with 1 being "poor" and 5 being "excellent". (**Table 1**)

Anectodical free text comments reported on the feedback form included:

- "This was one of the best, if not the best, simulation experiences that I have ever had."
- "It was really helpful to have the OB-GYN attendings – really great to learn from the perspective of a different specialty."
- "Great review of something that is very scary for many graduating residents. This should definitely be made part of our standard curriculum."
- "The entire sim day should be part of the core rotation. It was great and very high yield stuff we don't see, do, or talk about often."
- "Faculty would benefit from this as well."

Formal thematic analysis of free text responses was beyond the scope of this project.

DISCUSSION

Simulation holds a respected place in graduate and continuing medical education. Best practices in simulation, including clear learning objectives, deliberate practice, and debriefing, were incorporated into this project. [6] Indeed, the success of a simulation course is dependent on many factors. Based on the experience described, it is suggested that an interdepartmental, collaborative model of simulation development and implementation optimizes the success of the simulation educational program.

The process of creating this curriculum involved multiple preparation meetings including OB-GYN, PEM, and EM faculty. The coordination across departments was key to creating a meaningful learning experience. For example, scenario choice and design was a collaborative effort. OB-GYN faculty identified that maternal morbidity and mortality in the United States stems mainly from obstetric hemorrhage and hypertensive disorders of pregnancy. EM faculty agreed these topics were low frequency, high stakes encounters in the emergency department.

The faculty practiced with the models in advance to get a feel for the capabilities of the simulators and the force of the shoulder dystocia. There was also a briefing with the standardized patient who participated as the patient with preeclampsia. The overall timeline was six months. This lead time was required to keep the day free from clinical commitments for all of the faculty and prepare for the resident experience. It also allowed for adequate scheduling of the simulation space and the preparation by the simulation operations team to secure the necessary materials and simulator programming.

An interesting by-product of this interdepartmental collaborative effort was the conversations started between faculty and residents in different disciplines. It was quickly apparent that the perspective and treatment patterns varied between OB-GYN and EM. This is likely due to the different practice environments, resources, patient population, educational backgrounds, training, and common literature experienced by these two groups. Sharing these perspectives broadens everyone's education and helps break down departmental silos.

Many elements coalesce in the formation of a successful simulation-based educational event. The right mix of people, curriculum, technology, and simulation space creates the recipe for success. When an interdepartmental, collaborative approach is added into the mix, the stage is set for knowledge and perspective sharing of all involved.

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References

1. Fung L, Boet S, Bould MD, et al. Impact of crisis resource management simulation-based training for interprofessional and interdisciplinary teams: A systematic review. *J Interprof Care.* 2015;29(5):433-444.
2. Zendejas B, Brydges R, Wang AT, Cook DA. Patient outcomes in simulation-based medical education: a systematic review. *J Gen Intern Med.* 2013;28(8):1078-1089.
3. Barsuk JH, Cohen ER, Potts S, et al. Dissemination of a simulation-based mastery learning intervention reduces central line-associated bloodstream infections. *BMJ Qual Saf.* 2014;23(9):749-756.
4. McGaghie WC, Issenberg SB, Barsuk JH, Wayne DB. A critical review of simulation-based mastery learning with translational outcomes. *Med Educ.* 2014;48(4):375-385.
5. Morey JC, Simon R, Jay GD, et al. Error reduction and performance improvement in the emergency department through formal teamwork training: evaluation results of the MedTeams project. *Health Serv Res.* 2002;37(6):1553-1581.
6. Motola I, Devine LA, Chung HS, Sullivan JE, Issenberg SB. Simulation in healthcare education: a best evidence practical guide. AMEE Guide No. 82. *Med Teach.* 2013;35(10):e1511-1530.

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Disclosures

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