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Educational Objectives

By the end of this activity, learners will be able to:

1. Complete a vaginal delivery via simulation birthing model
2. Explain the steps of the spontaneous vaginal delivery process
3. Recognize obstetric patient emergencies
4. Communicate appropriate treatment and management for different obstetric emergencies including shoulder dystocia, umbilical cord prolapse, preeclampsia/eclampsia, and postpartum hemorrhage
5. Improve ability to function as part of a healthcare team

Abstract

Introduction: Simulation is rarely used for medical student education in the field of obstetrics. This method is an effective model of learning for topics that are encountered in clinical situations and for topics that pose significant risk to patients when an untrained individual is involved. **Methods:** A 2-hour obstetric delivery simulation session was developed and incorporated into the third-year obstetrics and gynecology clerkship rotation at Wright State University Boonshoft School of Medicine. Medical students completed self-guided content reviews with resources provided prior to the session. During the session, each medical student conducted a normal vaginal delivery and one of the emergent cases (umbilical cord prolapse, pre-eclampsia/eclampsia, shoulder dystocia, and postpartum hemorrhage). During each case the Resident facilitator followed a script which included asking questions using gamification strategies to promote a low-stress learning environment. Critical action checklists were used to ensure students gained a strong understanding of topics. Simulation sessions were conducted both remotely and in-person. The simulation experience was evaluated using surveys and quizzes completed prior to and after participating in the simulation session. **Results:** Students reported that the simulation experience increased their comfort with emergent obstetric situations, increased their medical knowledge, and was beneficial to their education. **Discussion:** Simulation is an untapped learning method in obstetrics. We developed simulations for obstetric events to provide medical students with hands-on exposure to important obstetric experiences. This simulation session provides the framework for other medical schools to incorporate these obstetric simulations into their clerkship curriculum.

Keywords: obstetrics, simulation, emergency, medical students, clerkship

Introduction

Clinical education for medical students is enhanced with exposure to real clinical situations and live patients. This can be challenging for a variety of reasons including ensuring patient safety, timing of clerkships, limiting exposure to certain health conditions, and disrupting standardization of care.^{1,2} These challenges can leave medical students with inadequate exposure and preparation for important clinical situations. While other specialties, e.g., emergency medicine, pediatrics and internal medicine, use simulation to educate residents and medical students, the field of obstetrics and gynecology (OBGYN) has yet to fully embrace simulation in education.

The American Board of Emergency Medicine has implemented patient-based cases in their oral boards by utilizing technological resources.³ However, simulation in medical education is not widely used, even with recommendations from the Council of Residency Directors and the Association of Surgeons in Training. In one survey of 90 medical schools conducted by the Association of American Medical Colleges, 65% of medical schools reported using simulation for internal medicine, pediatrics, and emergency medicine, however less than 25% reported using simulation in OBGYN.⁴ Some specialties rely heavily on simulation for resident education, but medical students can benefit by learning alongside residents.⁵ Simulations improve education for rare and emergent situations and facilitate learning by revisiting previous clinical experiences to allow reflection and solidifying information without fear of adverse outcomes.^{6,7} In OBGYN, simulations have been shown to increase medical students' confidence, comfort with procedures, and medical knowledge on routine tasks such as vaginal delivery.^{8,9,10}

There are few simulations for managing obstetrical emergencies in the MedEdPORTAL database. Our search for "OB/obstetrics simulation" and "emergency obstetric simulation" yielded two results (i.e., an OB/Neonatology simulation for students and a Sepsis and Hemorrhage simulation for residents). The limited availability of obstetric simulations presents a challenge for medical educators as many emergency cases in obstetrics may not be adequately addressed during a clerkship rotation because they are rare or because student roles are limited in critical situations. Additionally, the onset of the COVID-19 pandemic required immediate shifts in learning environments to off-site and remote settings, further limiting options for maintaining the necessary experiential learning for third-year students.

We present a simulation session on obstetric emergencies for medical student education. We incorporated gamification strategies to produce a non-graded low-risk, high-reward educational experience. This simulation provides students with hands-on experience for a normal spontaneous vaginal delivery and high-risk, potentially life-threatening, emergent obstetric cases regardless of whether they experience these events directly on their clerkship rotation. This article provides the framework and tools to allow other programs to execute a standardized simulation into their OBGYN clerkships.

Methods

Development

The simulation session was developed and added as a mandatory activity on the third-year OBGYN clerkship in 2020 at the Boonshoft School of Medicine, Wright State University, Dayton, Ohio. The session was developed during the COVID pandemic and was initially executed remotely and, later, executed as in-person or as a combination of in-person and remote learners when students were in quarantine or at distant sites for clerkship. The simulation covers a normal spontaneous vaginal delivery and four unique obstetrical emergency cases (umbilical cord prolapse, shoulder dystocia, pre-eclampsia/eclampsia and postpartum hemorrhage). The spontaneous vaginal delivery simulation was designed to give students an opportunity to practice the technique of delivering an infant to be better prepared for their OBGYN rotation. The four emergent cases were designed to give students exposure to obstetric emergencies, that might not be experienced in the live clinical setting during their rotation and to prepare them to assist the care team in the event they encountered such a situation while on clerkship. The simulation cases were created as hypothetical patients developed by the authors. Appendix A includes an overview and timeline for the simulation.

All medical student learners were on their third-year OBGYN clerkship. One week prior to the simulation session, students received educational materials for a normal vaginal delivery and obstetric emergencies. Student content

review materials included IJWH and ACOG articles^{11,12,13,14} and optional educational videos to provide basic information on how to complete a vaginal delivery and how to manage obstetric emergencies - including vital sign and physical exam abnormalities, medications, potential side effects, etc. (Appendix B). Students were asked to complete the pre-simulation quiz and an optional pre-simulation survey.

The Resident facilitator (a Family Medicine or Emergency Medicine resident rotating in obstetrics), a fourth-year medical student pursuing an OBGYN residency, and an attending faculty member received simulation materials (Appendices E-I) including case descriptions, scripts, key teaching points in the critical action checklist, simulation set-up instructions, and the students' content review materials.

Equipment/Environment

We used a high-fidelity NOELLE labor and delivery simulation mannequin available at our institution. A birthing pelvis model can be substituted. The simulations took place in the Labor and Delivery Simulation Lab at the hospital. Additional equipment included a labor and delivery hospital bed, a baby mannequin, and lubrication. Appendix D includes the equipment requirements and simulation set-up instructions. When there were remote learners, a device (tablet, laptop, or cell phone) was utilized to stream the simulation video and allow remote students to verbalize responses. Additional equipment included:

1. Spontaneous vaginal delivery: Delivery instrumentation tray, bulb suction to demonstrate commonly used tools, model of placenta and cord.
2. Shoulder dystocia: No additional equipment (optional: Forceps and vacuum for demonstration of use.)
3. Preeclampsia/Eclampsia: No additional equipment (optional: O₂ tubing and rebreather mask for demonstration). To model seizures, the resident facilitator would shake the mannequin.
4. Umbilical cord prolapse: Model of placenta with umbilical cord protruding from the mannequin's introitus in a manner consistent with prolapse.
5. Postpartum hemorrhage: Imitation blood clots under the gown near the vaginal introitus.

Facilitators were provided with scripts (Appendices E-I) that contained question prompts for learners with ideal responses indicated. We developed the simulation scripts with goals and expectations for learner actions with their current knowledge level in mind. Critical Action Checklists were developed for each simulation based on the facilitator scripts. Students were not expected to execute or identify all items on the checklists to maintain the low stress learning environment. We hoped students could execute or identify most of the items on their own including the use of fellow classmates via lifelines. Facilitators prompted learners during the simulation and the debriefing to identify the critical action checklist items and provided education for any items that were unknown or a source of confusion for learners.

Personnel

Required personnel include an OBGYN faculty member, a Family Medicine or Emergency Medicine resident, and four to five third year medical students on their clerkship rotation. An optional fourth year medical student who was pursuing an OBGYN residency was utilized when available. The roles are described below and in Appendix D.

OBGYN Faculty Member: A clinical OBGYN faculty member was present for the whole simulation to oversee/lead the spontaneous vaginal delivery. After demonstrating a delivery, they observed and instructed each student through the delivery process. The faculty member answered questions beyond the scope of the off-service residents and fourth-year medical students.

Resident Facilitator: A Family Medicine or Emergency Medicine resident completing their OBGYN rotation functioned in a narrative role, not an active character role. For some cases, they expressed statements coming from the patient, family, or friends. Facilitators would ask questions to prompt learners to verbalize their knowledge of the conditions, understanding of the case, and ideas for management.

Fourth Year Medical Student: A fourth year medical student who was pursuing an OBGYN residency assisted the Resident Facilitator during the simulation sessions. They worked alongside the Resident Facilitator to help lead, set up, and teach cases.

Student Leader: Each student served as a leader for one of the four obstetric emergency cases. Case information was provided to the students verbally by the resident facilitator on the day of the simulation. As the leader for the case, each student was responsible for completing the actions of their assigned emergency case and answering the case questions. When it was time for a remote learner to lead the case, the remote student learner verbally instructed a classmate who was in-person to conduct any physical actions and answered the prompts over the video communication system.

Simulation sessions were conducted in groups of 4-5 medical students. Each student conducted a normal vaginal delivery overseen by the OBGYN faculty member and was assigned to lead one emergency case. The remaining students observed the case and participated in question lifelines and during the debriefing. Student learners could be in-person or remote.

Implementation

The simulation session was conducted on one day of each clerkship rotation. Students were notified of the simulation session during clerkship orientation and were sent reminders to complete a pre-simulation quiz and survey (Included in Appendix C). One week prior to the session, students received the content review materials with resources for the topics covered during the simulation session (Included in Appendix B).

The simulation session was conducted in the Labor and Delivery Simulation Laboratory with the equipment previously listed. Sessions were in 2-hour blocks with 4-5 students in each session allowing approximately 25 minutes for each case. Four blocks were needed for each clerkship rotation to accommodate the number of students in the rotation. Small groups provided an intimate learning environment allowing ample time for hands-on experience with the simulation model and the ability to gauge each student's knowledge in a low-pressure environment.

The Resident Facilitator and fourth year medical student set up the simulation room and provided an overview for the structure of the session: a normal vaginal delivery demonstration, then each student performing a vaginal delivery, and then the four emergency obstetric simulation cases. When there were 5 students in the group, the preeclampsia/eclampsia case had a built-in midway point that could be used to switch to a different student leader who finished the case.

Resident Facilitators used scripts to lead the simulations. The Facilitator presented the case information verbally to the Student Leader. If there were characters other than that of the narrator (i.e., pregnant patient, family, friend), the Facilitator would verbalize when they were taking on another role temporarily.

In order to create a low-risk and enjoyable environment, we introduced Who Wants to be a Millionaire™ response options, allowing student leaders different “lifelines” if they desired help answering the prompts during their cases. Lifelines included: Phoning a friend – asking one classmate for help; Polling the audience – all classmates could contribute; and requesting a 50/50 – the student was given two answer choices. For the 50/50 lifeline, it was up to the facilitator to select the two answer options.

At the end of each case, the Resident Facilitator reviewed the appropriate Critical Action Checklist to ensure all points had been discussed. There was a short debriefing session where students were able to ask questions of the OBGYN faculty member while the resident facilitator and fourth year medical student set up the model for the next case.

Debriefing

Cases were designed to include discussion throughout the simulations. This allowed the debrief sessions to be shorter conversations. Facilitators had the option to review the simulation specific content from the pre-simulation quiz. The faculty member was available to answer questions. The Facilitator also asked students for feedback on

how the simulation went, including inquiring about any questions they had on the material covered or would have done anything differently.

Once all simulations had been completed, the students were reminded to complete the post-simulation quiz and optional survey and were dismissed. The Facilitator and fourth year medical student cleaned up the room and put away materials and equipment.

Assessment

Prior to simulation day, and after receiving educational materials, students completed a short, optional, pre-simulation survey. Students answered questions on a 1-to-5 Likert scale, with 1 being “strongly disagree/low” and 5 being “strongly agree/high/excellent”. The same questions were asked in a post-simulation survey. Survey responses were compared using an independent t-test because they were completed anonymously and could not be matched.

Students also completed a pre-simulation quiz to assess their baseline knowledge. We scored these as a percentage of correct answers. At the end of the session, students completed the post-simulation quiz. The questions remained the same for the pre- and post-assessment quizzes, but the order of the questions was changed. Together, the survey and quiz addressed how well the simulation was received by student learners, whether it increased students’ comfort level to assist in obstetric emergencies, and whether there was an increase in knowledge after the simulation. Quiz responses were compared using paired t-test.

Resident Facilitators were asked to complete a post-simulation feedback survey to provide information to improve the learning experience, what they learned, and whether they had used information from the simulation in their clinical practice. Assessments are included in Appendix C.

Results

Eighty-six student learners completed the optional pre-simulation survey, and 102 student learners completed the post-simulation survey out of 201 total students over 6 clerkship cohorts. Students indicated significantly greater preparedness (Pre=1.77 vs Post=3.64, $p < .001$), confidence with hands-on procedures (Pre=1.85 vs Post=3.67, $p < .001$), and overall willingness to volunteer (Pre=3.37 vs Post=4.28, $p < .001$) after completion of the simulation. Medical students also indicated significantly greater interest (Pre=4.20 vs Post=4.47, $p < .001$), medical knowledge/comprehension (Pre=4.35 vs Post=4.70, $p < .001$), and skill level (Pre=4.35 vs Post=4.64, $p = .002$) regarding the addressed topics. Finally, students believed the simulation to be realistic and genuine to experiences within the hospital (Pre=3.90 vs Post=4.30, $p < .001$), overall beneficial to their learning (Pre=4.38 vs Post=4.80, $p < .001$), and valued the pre-simulation reading material as they translated to their clinical application with real patients (Pre=4.06 vs Post=4.71, $p < .001$).

	Pre-Simulation (n=86)		Post-Simulation (n=102)		P
	M	SD	M	SD	
Preparedness for rotation	1.77	0.78	3.64	0.69	<.001
Confidence in hands-on procedures	1.85	0.90	3.67	0.76	<.001
Willingness to volunteer	3.37	1.26	4.28	0.78	<.001
Topics were interesting	4.20	0.92	4.47	0.54	<.001
Knowledge and comprehension	4.35	0.72	4.70	0.54	<.001
Skill level	4.35	0.70	4.64	0.58	.002
Realistic to hospital setting	3.90	0.78	4.30	0.73	<.001
Beneficial to learning	4.38	0.72	4.80	0.47	<.001
Valued reading materials	4.06	0.83	4.71	0.56	<.001

The post-simulation survey included additional questions for whether students would recommend the simulation to others (Mean= 4.79) and whether the simulation strengthened their overall clerkship experience (Mean=4.73).

Students believed the technology was appropriate (Mean=4.05), did not hinder their learning (Mean=4.05), and aided those who completed the simulation remotely (Mean=4.09). However, students reported that they were less likely to recommend completing the simulation remotely, indicating they preferred learning in-person (Mean=2.32).

Table2. Post-simulation Survey Responses from Medical Students		
	Post-Simulation (n=102)	
	M	SD
Recommend simulation for other students	4.79	0.49
Simulation strengthened clerkship experience	4.73	0.53
Technology was appropriate	4.05	0.95
Technology did not hinder learning	4.05	0.95
Technology aided those who were remote	4.09	0.95
Recommend completing simulation remotely	2.32	1.38

Students completed pre- and post-simulation quizzes assessing their knowledge of the OB emergencies which was counted as part of their clerkship grade. There was a significant increase in average quiz scores after completing the simulation (Pre=67.1%±13.1% vs Post=76.0%±8.89%, p<.001). This is consistent with students' survey scores indicating that the simulation was beneficial to the overall clerkship and to their medical knowledge of obstetrics.

Feedback from Resident Facilitators was positive. Residents indicated that they enjoyed the experience. Some suggested that the simulation could be improved by including nurses for a more multidisciplinary approach. Other Residents desired greater access to resources beforehand. Both Family Medicine and Emergency Medicine Residents indicated their intention to use the information learned in OB simulation during their future career or had already used some of the information.

Discussion

Students reported greater comfort, preparedness, and medical knowledge for emergent obstetric cases after participating in the simulation session. Post-simulation quiz scores were consistent with their reported increase in knowledge. Additionally, students reported having valued the experience and believing it was beneficial to their education. Feedback from the Resident Facilitators was consistent with the objectives of the session and reflected the benefits shared by the medical students. Our findings are consistent with reports from simulations in emergency medicine in that students and residents were positively impacted by simulation-based learning.³ This study demonstrates the effectiveness and feasibility of our simulation session and adds a new option for medical educators where options are limited, particularly when education needs are virtual as they were during the COVID pandemic.¹⁵ This simulation incorporates available technology to allow OBGYN programs to execute a completely remote educational experience for medical students while maintaining similar benefits of live clinical training.

This study is limited in several areas. First, surveys were optional which may introduce selection bias from those who were more likely to complete surveys and may have skewed toward positive responses. In addition, we did not require that the pre-simulation quiz be completed prior to reviewing the pre-simulation content review materials. This likely reduced the magnitude of change for knowledge on the quizzes, although the change was statistically significant regardless of potential impact. One strength of this study is that the simulation sessions were, by design, led by different individuals of varying teaching capacity and prior knowledge. We examined the students' post-simulation survey responses by cohort and noted only one difference in that students in the first and fourth cohorts reported higher willingness to volunteer than the other cohorts. There were no other differences among the cohorts on the remaining survey questions or on the post-simulation quiz percentage scores, including the change in scores compared to pre-simulation quiz scores. These results demonstrate the consistency of the educational outcomes of the simulation using facilitators with a variety of skill and knowledge levels.

It is important to continue developing simulation-based education in OBGYN to increase students' exposure to emergent situations and expand hands-on educational options for medical students. This simulation is one step in that direction. As educators we must continue to evaluate what it means to be a successfully trained physician and how we measure this attainment. More research with effective medical education models is necessary to ensure that patients and communities benefit from the well-educated and trained students becoming medical doctors, so that even in emergent situations both providers and patients are safe.

References

1. Wenrich MD, Jackson MB, Wolfhagen I, Ramsey PG, Scherpbier AJJ. What are the benefits of early patient contact? - A comparison of three preclinical patient contact settings. *BMC Med Educ.* 2013;13(1). doi:10.1186/1472-6920-13-80
2. Abas T, Juma FZ. Benefits of simulation training in medical education. *Adv Med Educ Pract.* 2016;7. doi:10.2147/AMEP.S110386
3. Chakravarthy B, Ter Haar E, Bhat SS, McCoy CE, Kent Denmark T, Lotfipour S. Simulation in medical school education: Review for emergency medicine. *West J Emerg Med.* 2011;12(4). doi:10.5811/westjem.2010.10.1909
4. Passiment M, Sacks H, Huang G. *Medical Simulation in Medical Education: Results of an AAMC Survey. Association of American Medical Colleges 2011.* Washington, D.C.; 2011.
5. Pourmand A, Woodward C, Shokoohi H, et al. Impact of Asynchronous Training on Radiology Learning Curve among Emergency Medicine Residents and Clerkship Students. *Perm J.* 2018;22. doi:10.7812/TPP/17-055
6. Acosta T, Sutton JM, Dotters-Katz S. Improving Learners' Comfort With Cesarean Sections Through the Use of High-Fidelity, Low-Cost Simulation. *MedEdPORTAL J Teach Learn Resour.* 2020;16. doi:10.15766/mep_2374-8265.10878
7. Fielder EK, Lemke DS, Doughty CB, Hsu DC, Middleman AB. Development and assessment of a pediatric emergency medicine simulation and skills rotation: meeting the demands of a large pediatric clerkship. *Med Educ Online.* 2015;20. doi:10.3402/meo.v20.29618
8. Vellanki VS, Gillellamudi SB. Teaching surgical skills in obstetrics using a cesarean section simulator – bringing simulation to life. *Adv Med Educ Pract.* 2010;1. doi:10.2147/AMEP.S14807
9. Jude DC, Gilbert GG, Magrane D. Simulation training in the obstetrics and gynecology clerkship. *Am J Obstet Gynecol.* 2006;195(5). doi:10.1016/j.ajog.2006.05.003
10. Holmström SW, Downes K, Mayer JC, Learman LA. Simulation training in an obstetric clerkship: A randomized controlled trial. *Obstet Gynecol.* 2011;118(3). doi:10.1097/AOG.0b013e31822ad988
11. Shoulder dystocia. Practice Bulletin No. 178. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;129:e123–33. doi: 10.1097/AOG.0000000000002039
12. Gestational hypertension and preeclampsia. ACOG Practice Bulletin No. 222. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2020;135:e237-60. doi: 10.1097/AOG.0000000000003891
13. Sayed Ahmed WA, Hamdy MA. Optimal management of umbilical cord prolapse. *Int J Womens Health.* 2018;10:459-465. Published 2018 Aug 21. doi:10.2147/IJWH.S130879
14. Postpartum hemorrhage. Practice Bulletin No. 183. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;130:e168–86. doi:10.1097/AOG.0000000000002351
15. Papapanou M, Routsis E, Tsamakis K, et al. Medical education challenges and innovations during COVID-19 pandemic. *Postgrad Med J.* 2022;98(1159). doi:10.1136/postgradmedj-2021-140032

Appendices

- A. Overview and Timetable
- B. Medical Student Content Review Materials

- C. Surveys and Quizzes
- D. Simulation Day Set up Guide
- E. Normal Vaginal Delivery Simulation Materials
- F. Shoulder Dystocia Simulation Materials
- G. Preeclampsia-Eclampsia Simulation Materials
- H. Umbilical Cord Prolapse Simulation Materials
- I. Postpartum Hemorrhage Simulation Materials