

EDUCATION

A randomized controlled trial of birth simulation for medical students

Christopher C. DeStephano, MD, MPH; Betty Chou, MD; Silka Patel, MD, MPH;
Rebecca Slattery, BS; Nancy Hueppchen, MD, MSc

OBJECTIVE: The objective of the study was to evaluate the effectiveness of a high-fidelity birth simulator (Noelle; Gaumard Scientific, Coral Gables, FL) compared with a lower-cost, low-tech, birth simulator (MamaNatalie; Laerdal Medical, Stavanger, Norway) in teaching medical students how to perform a spontaneous vaginal delivery (SVD).

STUDY DESIGN: Prior to the obstetrics-gynecology clerkship, students were randomly assigned to 2 groups. The MamaNatalie group (MG) completed 45 minutes of SVD simulation using an obstetrical abdominal-pelvic model worn by an obstetrics-gynecology faculty member. The Noelle group (NG) completed 45 minutes of SVD simulation using a high-fidelity, computer-controlled mannequin facilitated by an obstetrics-gynecology faculty member. The primary outcome was student performance during his or her first SVD as rated by supervising preceptors. Surveys were also completed by students on confidence in performing steps of a SVD (secondary outcome).

RESULTS: One hundred ten medical students (95% of those eligible) participated in this research study. The final postclerkship survey was completed by 93 students (85% follow-up rate). There were no significant differences in performance of SVD steps between MG and NG

students as rated by preceptors. The SVD step with the least involvement by students was controlling the head (20.5% in MG, 23.3% in NG performed step with hands-off supervision). Delivery of the placenta was the SVD step with the most involvement (65.9% in MG, 52.3% in NG performed step with hands-off supervision). Baseline presimulation confidence levels were similar between MG and NG. On the immediate postsimulation survey of confidence, MG students were significantly more confident in their ability to deliver the abdomen and legs and perform fundal massage with hands-off supervision ($P < .05$) than NG students. Following the clerkship, MG students were significantly more confident in their ability to control the head and deliver the abdomen and legs ($P < .05$) than NG students.

CONCLUSION: MamaNatalie is as effective as Noelle in training medical students how to perform a SVD and may be a useful, lower-cost alternative in teaching labor and delivery skills to novice learners. Because birth simulation interventions involve both a simulation model and facilitator, research is required to further determine the effect of human interaction on learning outcomes.

Key words: medical student education, obstetric simulation

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Over the past 2 decades, several models of undergraduate medical education have been introduced to promote self-directed, active learning. These include problem-based learning, discovery

learning, experiential learning, task-based learning, and peer evaluation.¹ The Association of Professors of Gynecology and Obstetrics has recommended these learning strategies to augment the clinical experiences and skill acquisition because traditional learning utilizing laboring patients “may lead to poor or incomplete skill acquisition ... in a fast-paced, high-stress learning environment without standardization of knowledge expectations.”^{2,3}

Simulation is a promising approach to meet Association of Professors of Gynecology and Obstetrics’s recommendations because it offers the opportunity for students to make mistakes in a safe, controlled setting, participate in a variety of simulated experiences, and use repetition to aid learning.^{4,5}

Literature supports the use of the Noelle (Gaumard Scientific, Coral Gables, FL) birth simulator for teaching novice

medical students how to clinically monitor the stages of labor and manage a normal vaginal delivery prior to the obstetrics and gynecology clerkship (Figure 1). Jude et al⁶ reported that medical students who practiced deliveries on a simulator reported higher levels of confidence in their skills to perform vaginal deliveries compared to lecture alone. Deering et al⁷ showed that additional training with an obstetric simulator improved student self-reported comfort with basic procedures performed on labor and delivery (fundal height measurements, Leopold maneuvers, fetal scalp electrode placement, intrauterine pressure catheter placement, and artificial rupture of membranes) compared with resident and staff-directed instruction.

In the largest study comparing traditional lecture to lecture plus hands-on vaginal delivery simulation, Holmstrom

From the Department of Gynecology and Obstetrics, The Johns Hopkins University School of Medicine, Baltimore, MD.

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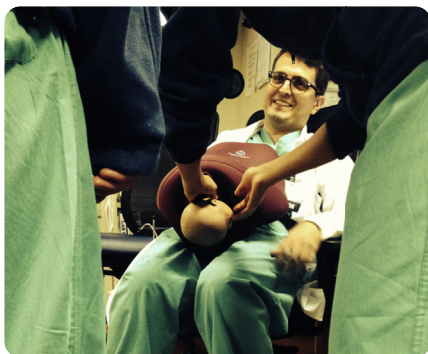
Corresponding author: Christopher C. DeStephano, MD, MPH. cdestep1@jhmi.edu

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FIGURE 1
Image of facilitator teaching vaginal delivery steps using MamaNatalie



MamaNatalie; Laerdal Medical, Stavanger, Norway.

DeStephano. Comparison of birth simulators. *Am J Obstet Gynecol* 2015.

et al⁸ again showed improved confidence in ability to perform a vaginal delivery and also showed higher scores on oral and written examinations in the group of students who received simulation training.

Previous studies predominantly evaluate learner confidence following simulation. However, reports of student performance as rated by preceptors while students are on labor and delivery are sparse. This limits the conclusions that can be made about simulation training for teaching novice medical students prior to the obstetrics and gynecology rotation. If adequate teaching and feedback occurs during simulation, confidence is expected to follow. However, it is unclear whether this results in improved student performance on labor and delivery. An unskilled, overly confident medical student is potentially dangerous.

The cost of Noelle and other high fidelity models (\$4000–50,000) and lack of easy portability has limited the use of birthing simulation in limited resource settings and during the clerkship. A lower-cost (\$750), portable birth simulator, MamaNatalie (Laerdal Medical, Stavanger, Norway) was designed to address these issues (Figure 2). The simulator is worn by an instructor who acts as the patient, thus providing

person-to-person communication and fidelity to replicate real patient interactions.

The portable simulator eliminates the mechanical barriers of other simulators, can be carried in a backpack, and can simulate normal vaginal deliveries, delivery of the placenta, and postpartum hemorrhage. Although a theoretically promising model for teaching labor and delivery skills, previous studies have not evaluated the effectiveness of MamaNatalie for teaching novice learners how to perform a spontaneous vaginal delivery.

This study was designed to evaluate the effectiveness of a high-fidelity birth simulator (Noelle) compared with a lower-cost, low-tech, lower-fidelity birth simulation model (MamaNatalie) in teaching medical students how to perform a spontaneous vaginal delivery.

MATERIALS AND METHODS

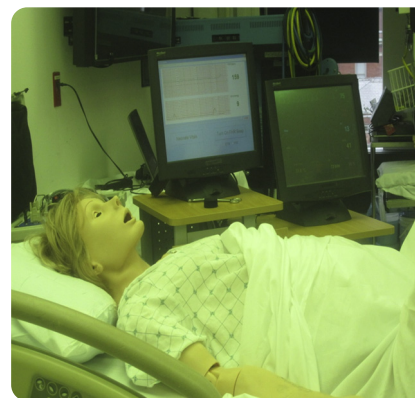
This was a randomized controlled trial comparing two birth simulators (MamaNatalie and Noelle) when teaching medical students a normal vaginal delivery. Students rotating on the Women's Health Clerkship from March 2013 to March 2014 were invited to participate in the research study. On the front page of the survey students received prior to the birth simulation experience, students were informed that "completion of this anonymous survey or questionnaire will serve as your consent to be in the research study."

This study enrolled every medical student who completed the survey during the 1 year study. The Johns Hopkins University School of Medicine Institutional Review Board approved the study (protocol NA 00074248).

During their women's health clerkship orientation, students participate in various active learning modules to prepare them for the obstetrics portion of the clerkship. These modules include a lecture on normal/abnormal labor and evidence-based prenatal care, discussion and evaluation of electronic fetal monitoring cases, simulation of infant resuscitation, and simulation of normal vaginal delivery.

Prior to initiation of the research study in March 2013, students in the

FIGURE 2
Image of the Noelle birth simulator



Noelle; Gaumard Scientific, Coral Gables, FL.

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clerkship were divided into groups of 6 and allotted 45 minutes for birth simulation using Noelle following a 1 hour lecture on normal/abnormal labor. Upon initiation of the study, students continued to receive the same labor lecture followed by the birth simulation experience using either the Noelle (Noelle group [NG]) or the MamaNatalie (MamaNatalie group [MG]), still in groups of 6.

All students rotating on the women's health clerkship from March 2013 to March 2014 were enrolled by the program coordinator, assigned a random number, and randomly assigned to NG or MG. For the allocation of the participants, the program coordinator (investigator R.S., who did not teach students during orientation) used Microsoft Access to generate a random number for each student prior to each rotation.

Following simple randomization procedures, the program coordinator randomly assigned the deidentified numbers to either NG or MG in a spreadsheet. The allocation sequence was concealed from her during the assignment of numbers to groups because only the deidentified numbers were assigned to NG or MG (she was blinded to all student names up to this point in the process). Once the

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