Effect of Birth Simulator-Based Teaching of Vaginal Delivery on Undergraduate Learning and Satisfaction

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Short running title:
Birth simulator for teaching vaginal delivery.
Abstract:

Background: Although the traditional method of teaching vaginal delivery at the Obstetrics and Gynecology Department of King Abdulaziz University (KAU) through lecture and observation in the labor room seems to be helpful for students’ learning, it was insufficient to elicit student satisfaction.

Objectives: This study aims to evaluate the effect of using a birth simulator during teaching vaginal delivery versus observation of normal labor at the labor room on students’ satisfaction and learning.

Materials and Methods: Utilizing birth simulator was included in the curriculum of Obstetrics and Gynecology’s undergraduate clerkship taught to the fifth-year medical students during 2013 in addition to the routine lectures and observation of real vaginal delivery in the labor room. A cross sectional study using a questionnaire was conducted to explore students’ satisfaction and learning with this method.

Results: The majority of the respondents showed significant satisfaction as well as self-reported learning of normal labor using a birth simulator (NOELLE) compared with the simple observation at labor room.

Conclusion: Teaching vaginal delivery using the NOELLE birth simulator improved student learning and satisfaction compared to the simple observation of real labor at the labor room.

Keywords: Obstetrics; simulation; labor and delivery; skills.

Introduction

Recent advances in technology have positioned simulations as a powerful tool for creating more realistic, experiential learning environments and thereby helping organizations meet these emerging training challenges. Several studies regarding simulation-based training revealed its potential benefits to serve as an alternative tool to real clinical practice among students and medical professionals (Bell and Kozlowski 2007). Enhanced patient safety on one hand has to be the ultimate outcome of any medical curriculum while on the other hand, it itself can be potentially compromised in an apprenticeship-based model of medical education. Simulation techniques can be employed to enhance learning of healthcare professionals in safe environments, without compromising the patient safety, while maintaining a high degree of realism (Khan et al., 2011). In obstetrics in particular, simulation training may hold significant benefits for the training of medical students and residents, who not only face strict work-hour limitations, but also the emotionally charged labor and delivery ward where it is difficult and often awkward to teach during labor with expectant parents awaiting the birth of their child (Macedonia et al., 2003). Obstetrics simulators have been used to teach rare and catastrophic events to improve patient safety and improve the competency of the learners (Holmström et al., 2011).
Patients nowadays are reported to be more cautious about medical students being assigned to them (Okuda et. al., 2009). In addition, male students have been reported to be more likely to experience gender bias from patients in Obstetrics and Gynecology clinics (Chang et al., 2010). In environments where most patients are Muslim, this type of bias is more likely to be serious. One report from the United Arab Emirates found that women generally refuse to be examined by male students for abdominal and gynecological problems (McLean et al., 2010). In Saudi Arabia, an Islamic theocratic monarchy whose official religion is Islam, cultural and religious issues might also affect the attitudes of patients in Obstetrics and Gynecology clinics toward male medical students (Anfinan et al., 2014).

During their 12-weeks rotation in the Department of Obstetrics and Gynecology (OB-GYN), which is part of fifth-year medical students’ curriculum at King Abdulaziz University (KAU), students were given the opportunity to observe and write a report on labor. Unfortunately, many difficulties are facing medical students, particularly males, to attend labor and hence affecting their learning from and satisfaction with the course. Among these difficulties are the cultural beliefs of women in labor, the unpredictability of the labor time, the large number of the students and the limited number of students and time allowed to attend in the labor room.

Although studies describing the efficacy of these models are limited, available evidence suggests that training novices with these models results in better overall performance (Deering et al 2006). In a recent study conducted at Saudi Arabia, simulation was found to be effective in teaching procedural skills, diagnostic skills, communication skills, developing self-confidence and provides a safe and effective platform for practice without real harm (Nuzhat et al., 2014). Based on this and in order to overcome the aforementioned difficulties facing the students during their learning in the OB-GYN course, the Clinical Simulation Skill Center (CSSC) at KAU obtained a vaginal delivery simulator (NOELLE, see Figure 1) aiming to enhance the mode of teaching experience for both undergraduates and post-graduates. It also aimed to provide an alternative, active and safe method of learning instead of the passive one which depends on just observing real labor at the labor room. This stimulator was designed to provide a complete birthing experience before, during and after delivery. The aim of this study was to compare the effect of teaching vaginal delivery using a birth simulator versus observing real vaginal delivery at the labor room on students’ learning and satisfaction.

Materials and Methods:

Teaching normal delivery for undergraduate medical students using a simulator was designed as a comprehensive teaching system that combines the features of a patient mannequin and an advanced childbirth simulator. It aimed to provide a complete birthing experience before, during, and after delivery. NOELLE birthing simulator was used for the first time for this purpose.
A total of 116 fifth-year male medical students were enrolled in the OB-GYN course between September and November 2013. All students were instructed to attend the labor room to observe and write a report on real labor as well as to attend and participate in the normal labor simulation session at the CSSC in groups of six with an assigned role for each one of them. These roles included obstetrician, assistant, two midwives pediatrician, and pediatric nurse (Figure 2). The detailed guide of how this new teaching approach using simulation was implemented including session outcomes, the set-up, normal labor scenario and the time line of events during the scenario is fully described in the Tables (1-4).

### Table (1): Outcomes of the normal labor simulation session

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
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<tbody>
<tr>
<td><strong>A: Technical Skills</strong></td>
</tr>
<tr>
<td>1. Show how to approach the patient in labor</td>
</tr>
<tr>
<td>2. Demonstrate focused obstetric history of the patient in labor</td>
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<tr>
<td>3. Recognize the 2nd and 3rd stages of active labor</td>
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<tr>
<td>4. Describe the fetal position</td>
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<tr>
<td>5. Demonstrate modified roentgen maneuver for fetal head delivery</td>
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<tr>
<td>6. Demonstrate cord clamping</td>
</tr>
<tr>
<td>7. Demonstrate 3rd stage management</td>
</tr>
<tr>
<td>8. Demonstrate the obstetric role of immediate post-natal care of the baby</td>
</tr>
<tr>
<td>9. Demonstrate the post-partum care</td>
</tr>
<tr>
<td>10. Identify perineal lacerations</td>
</tr>
<tr>
<td><strong>B: Non-Technical Skills</strong></td>
</tr>
<tr>
<td>1. Demonstrate an effective communication with the labor room team</td>
</tr>
<tr>
<td>2. Demonstrate an effective communication with other specialty teams (pediatric,</td>
</tr>
<tr>
<td>anesthesia, etc.)</td>
</tr>
<tr>
<td>3. Demonstrate wise allocation of attention among the relatives</td>
</tr>
<tr>
<td>4. Practical documentation skills within the time limit</td>
</tr>
</tbody>
</table>

**Figure (1): NOELLE Birthing and Maternal Simulator**

**Figure (2): 5th year medical students during simulation-based session in the clinical skills laboratory.**
Table (2): Setting up of the simulation session:

| Briefing | 1. The students will enter the simulation room and will be oriented by the confederate regarding their role.  
<table>
<thead>
<tr>
<th></th>
<th>2. The students will be grouped into 6 active participants, each one is delegated with a specific role and an announcement will be given to prompt the start of the scenario.</th>
</tr>
</thead>
</table>
| Preparation Checklist | 1. Control or Debriefing Room: Round table with 15 chairs, flip charts, screen, laptop, video-taping and still-picture  
|          | 2. Labor room: door sign (Labor and Delivery room)  
|          | 3. Gloves  
|          | 4. Scrub  
|          | 5. One-way mirror for observer and control area  
|          | 6. NOELLE birthing simulator  
|          | ✓ In lithotomy position, wearing hospital clothes  
|          | 7. Monitors  
|          | ✓ Standard (Noninvasive Blood Pressure-Spo2-Cardiotocography) attached to the patient  
|          | 8. Medications  
|          | ✓ Drugs drawn and ready (filled with water) in the drawer of the drug cart  
|          | ✓ Methergine  
|          | ✓ Oxytocin vial (attached to 3cc syringe)  
|          | 9. Documents available for candidates  
|          | ✓ History paper  
|          | 10. Investigation  
| Equipment | ✓ Cardiotocography and vital signs monitor  
|          | ✓ Delivery set (2 clamps, 2 scissors, gauze)  
|          | ✓ Delivery drape  
|          | ✓ Incubator for the baby and towel  
|          | ✓ Suction apparatus and tubing  
|          | ✓ Delivery bed with lithotomy position  
|          | ✓ 3-4 pelvis models for different cervical dilatation  
|          | ✓ Ventouse and forceps |

Quantitative analysis of the questionnaires and surveys was conducted using the SPSS 16.0 software package. Cronbach’s alpha was used to determine the internal consistency or average correlation of items in each survey to gauge its reliability. It was calculated and interpreted according to Cronbach (1951). Kolmogrov-Smirnov test was used to check the normal distribution of data. The results were expressed as mean and standard deviation. Paired t-test was used to compare the students’ perception in simulation lab and labor room. Independent student t-test was used to compare between perception of students who have the simulation and who do not have. Effect size was calculated and interpreted according to Cohen (1988) to measure the pre-/post-course differences in means in term of standard deviation units. The effect size was considered ‘small’ if it fell between (0.20-0.50), ‘medium’ between (0.50 -0.80) and it was considered ‘large’ at 0.80 or higher. Significance was considered at p value less than 0.05.
Table (3): Scenario of the Normal labor simulation session

<table>
<thead>
<tr>
<th>Scenario:</th>
<th>Stressed-out mother in labor</th>
</tr>
</thead>
</table>
| **Patient Profile** | Name of Patient: Suzan  
Age: 18 y/o  
PG: 39-weeks  
Gender: Female  
*Booked patient in labor, fully dilated* |
| **Past History:** | Medical: Nil  
Surgical: Nil  
Meds: Maternal Vitamins  
Allergies: Nil  
Family History: Nil |
| **Baseline Physical Exam (on Labor and Delivery sheet)** | Position: Lithotomy  
Vital signs: Blood Pressure: 129/80, Heart Rate: 90  
Respiratory Rate: 20  
SPO2: 98%, Temperature: 37.2 |
| **The participant(s):** | 2 Midwives  
2 Obstetricians  
2 Pediatricians |

Table (4): Time Line of events during the normal labor scenario:

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
</table>
| 0-1 minute | 2 doctors called by midwives/nurses  
*Patient is stress fully dilated*  
*Patient is connected to Cardiotocography and vital signs monitoring* |
| 2-5 minutes | Call seniors and pediatric |
| History    | *Check the antenatal booklet and partogram* |
| Examination | *Per Vagina: fully, Station +2* |
| Ask about Investigation |  
- *Complete blood count*  
- *Ultrasound*  
- *Antenatal care profile*  |
| 10-12 minutes |  
- *Lithotomy position*  
- *Deliver the baby with roahtgen maneuver and hand it over to the pediatrician*  
- *First resuscitations of the baby (suction: dry and warm) and APGAR Score*  
- *Deliver the placenta*  
- *Examine the following*  
  ✓ Vital signs  
  ✓ Abdomen: contracted uterus  
  ✓ *Per Vagina: lochia and check for perineal tear*  
| Last Documentation | |
Results:

Out of 116 students enrolled in the OB-GYN course, 99 (85.4%) responded to the questionnaires.

About 81% of the participants agreed that the culture and traditions make it difficult for the medical students to attend and observe real labor at the labor room.

Students’ satisfaction with their learning experience of using the normal labor simulator or observation at the labor room was assessed. Most of the responses were significantly high after the simulation session compared with that of the observation at the labor room except for two items; the proper observation of a real normal labor and the chance to demonstrate the different stages of labor clearly that showed non-significant difference between the two locations and the effect size in these two items was small (0.19 and 0.29) respectively. The effect size of the other items was either medium or high in favor of the simulation session (Table 5).

Table (5): Comparison of students’ satisfaction with normal labor simulation session and observation of normal labor in labor room

<table>
<thead>
<tr>
<th>Questions</th>
<th>Normal labor Simulation session Mean±SD N= 99</th>
<th>Observation of normal labor in labor room Mean±SD N=99</th>
<th>Effect size</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have chance to attend a real normal labor at a convenient time.</td>
<td>3.61±1.10</td>
<td>2.79 ± 1.19</td>
<td>0.75</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>I have chance to properly observe a real normal labor.</td>
<td>3.36±1.20</td>
<td>3.24 ± 1.16</td>
<td>0.19</td>
<td>0.443</td>
</tr>
<tr>
<td>I have chance to participate in the process of delivery.</td>
<td>3.53±1.08</td>
<td>2.39 ± 1.13</td>
<td>1.05</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>I have chance to demonstrate the different stages of labor clearly.</td>
<td>3.41±1.10</td>
<td>3.09 ± 1.11</td>
<td>0.29</td>
<td>0.40</td>
</tr>
<tr>
<td>I have chance to try the tools used in operative vaginal delivery.</td>
<td>3.47±1.09</td>
<td>2.45 ± 0.97</td>
<td>0.93</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>It was possible to watch an abnormal delivery at a convenient time</td>
<td>3.25±1.07</td>
<td>2.54 ± 1.04</td>
<td>0.66</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>The labor room/clinical skill lab provides a suitable environment for learning</td>
<td>3.81±0.97</td>
<td>3.02 ± 1.12</td>
<td>0.81</td>
<td>&lt; 0.001*</td>
</tr>
<tr>
<td>Overall, the quality of the experience was good</td>
<td>3.88±0.93</td>
<td>3.37 ± 1.02</td>
<td>0.54</td>
<td>&lt; 0.001*</td>
</tr>
</tbody>
</table>

Alpha cronbach

<table>
<thead>
<tr>
<th></th>
<th>Normal labor Simulation session Mean±SD N= 99</th>
<th>Observation of normal labor in labor room Mean±SD N=99</th>
<th>Effect size</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha cronbach</td>
<td>0.83*</td>
<td>0.64*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Students’ self-reported learning forms for the normal labor simulation session and the observation at labor room were also compared. It was found that almost all the learning objectives were significantly well perceived in the simulation session except two objectives: approaching and demonstrating focused history with patient in normal labor that showed non-significant difference. Although most of the learning objectives showed small effect size on students’ learning in both approaches, recognizing the 2nd and 3rd stages of active labor, demonstrating the post-partum care and identifying perineal lacerations showed medium effect size (0.58, 0.59 and 0.35 respectively) (Table 6).

Table (6): Comparison of students’ self-reported learning from normal labor simulation session and observation of normal labor in labor room

<table>
<thead>
<tr>
<th>After this session I can,</th>
<th>Normal labor Simulation session N= 99 N (%)</th>
<th>Observation of normal labor in labor room N=99 N (%)</th>
<th>Effect size</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. show how to approach the patient in labor</td>
<td>99 (100)</td>
<td>98 (98)</td>
<td>0.07</td>
<td>0.95</td>
</tr>
<tr>
<td>2. demonstrate focused obstetric history of the patient in labor</td>
<td>98 (98)</td>
<td>95 (95)</td>
<td>0.09</td>
<td>0.28</td>
</tr>
<tr>
<td>3. recognize the 2nd and 3rd stages of active labor</td>
<td>96 (96)</td>
<td>43 (43)</td>
<td>0.58</td>
<td>0.001*</td>
</tr>
<tr>
<td>4. describe the fetal position</td>
<td>94 (94)</td>
<td>81 (81)</td>
<td>0.20</td>
<td>0.003 *</td>
</tr>
<tr>
<td>5. demonstrate modified roentgen maneuver for fetal head delivery</td>
<td>91 (91)</td>
<td>82 (82)</td>
<td>0.12</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Discussion

In this study, large percentage (about 81%) of the participating students agreed that the culture and traditions make it difficult for them as male medical students to attend and observe real labor at the labor room. This finding is confirmed and explained with some previous studies. A local study conducted in Riyadh, Saudi Arabia to assess patients’ attitudes and their associated factors toward involving medical students in their care, the patient preference for the medical students of same sex was higher (about 58%). About 67% of patients in the obstetrics and gynecology department preferred to be examined by a physician alone, without the medical students and also wished to maintain their privacy (Abdulghani et al., 2008). Another regional study was conducted in the United Arab Emirates, one of the Arabic countries with Islamic culture and traditions similar to that of Saudi Arabia, showed that although about 87% accepted medical student involvement in obstetrics and gynecology outpatient care, about 60% and 66% of them preferred female students or preceptors respectively with significantly lower comfort levels.
with male students or preceptors particularly in pelvic examination and the discussion of sexual problems. Concern about privacy represents about 54% of reasons for non-acceptance (Rizk et al., 2002). This result also is in line with those of both international and other local studies (Al-Faris et al., 1994, Cooke et al., 1996, Adams et al., 1999; Grasby and Quinlivan 2001 and Stratton et al., 2005). In a study done to determine if performance differences exist between male and female students on obstetrics and gynecology clerkship, the final clerkship grades were significantly higher for females than for males and males reported completing fewer breast examinations (Craig et al., 2013). In a more recent study, the gender of the medical student was the primary factor that influenced patients’ decision to accept or decline medical student involvement. Fewer participants, seen at the outpatient and inpatient clinics of the obstetrics and gynecology department, at the Emergency Department or the Labor and Delivery Ward of King Abdulaziz University Hospital (KAUH), reported positive attitudes regarding the presence of male versus female medical students during consultations and examination (Anfinan et al., 2014).

In this study, students’ satisfaction with the simulation sessions at the CSSC was significantly high compared to that of the labor room. The convenience of being able to observe, perform, participate and encounter both normal and abnormal events in the process of labor were all possible to be done with the help of the NOELLE birthing simulator. Furthermore, the environment in the CSSC was more suitable environment for learning among the students, thus making the quality of experience good enough for the respondents. This observation was in line with that of Weller 2004 who reported that “medical students value simulation-based learning highly”. In particular, they value the opportunity to apply their theoretical knowledge in a safe and realistic setting, to develop teamwork skills and to develop a systematic approach to a problem. Studies by Dayal et al, 2009 and Jude et al., 2006 showed that “students who receive simulation training had more confidence to perform vaginal delivery maneuvers and participated in more live vaginal deliveries and participated more actively in the clinical environment during the course of clerkship”. Additional training with an obstetric simulator was found to improved medical student self-reported comfort with and understanding of basic obstetric procedures compared with standard resident and staff directed instruction (Deering et al., 2006)

In this study, simulation-based sessions of normal labor led to beneficial experiences to the undergraduate students’ self-reported learning of almost all learning objectives. These findings were in accordance with those of students receiving simulation training, who were significantly more confident in their ability to perform a vaginal delivery immediately after assessment than students who did not receive the simulation training. Compared to students who only studied through lectures, students with simulation practice scored significantly higher on their oral and written examinations 4 weeks after the intervention (Holmström et al., 2011). Reynolds et al., 2010 also reported that a simulated vaginal delivery improved short-term knowledge and satisfaction. In previous studies, simulation was described to
have great potential in the field of obstetrics as it allows for students to perform and receive feedback on common interventions and emergencies in the absence of any risk to real patients or infants (Deering et al., 2006), demonstrate competency maneuvers, and translate this competence into increased clinical participation and confidence (Dayal et al., 2009). Recently, simulation-based mastery learning or SBML was described to significantly improve skills for all participants, and also leads to skill retention (Motola et al., 2013).

Evidence is scarce to prove that students are able to retain the skills obtained via simulation-based sessions after a certain period. There was neither any concrete proof that its effects in terms of acquired competency and knowledge after exposure will be one and the same for everybody.

**Conclusion and recommendation:** The goal of bridging the gap between the classroom and clinical environment provided great ideas to introduce and utilize birth simulators in teaching vaginal delivery among undergraduates and other medical professionals. Truly it has been beneficial for their learning and satisfaction. But despite these advantages, lectures in the classroom setting and the actual scenario of labor in the labor room do still remain as the core foundation for obstetrics education.

While this study’s scope and limitations focused in determining the effects of simulation-based teaching among undergraduates, further research is needed to identify whether knowledge and skills acquired from simulation-based training is sufficient to say that one is competent, even after a certain period from the time of exposure.

**Acknowledgments:**

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**Declaration of interest:**

The authors report no declarations of interest.

**References:**


