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Innovations in Simulation

Wearable Simulated Maternity Model: Making Simulation Encounters Real in Midwifery

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clinical simulation;
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simulated model;
pregnancy

Abstract

Background: Vulnerable groups, such as pregnant women, are not used in immersive simulation. This can limit opportunities for students to practice real-life clinical examinations. Nonpregnant simulated patient involvement is of limited value if realistic physiological presentations that reflect body changes in pregnancy are unavailable to perform examinations.

Methods: The authors present an innovative and cost-effective high-fidelity method to create a wearable simulated maternity model that can be worn by nonpregnant actors to simulate pregnancy in immersive simulations in midwifery.

Results: In this article, we provide step-by-step instructions for constructing a wearable model simulating pregnancy. This enables students to palpate fetal position, listen to the fetal heart, and assess cervical dilation.

Conclusion: This simulation resource is cost-effective, is simple to implement, and is a highly effective means for simulating pregnancy and teaching skills and critical thinking in higher fidelity complex immersive scenarios.

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Background

Although clinical placements are a fundamental part of midwifery academic programs, clinical placement shortages are impacting the delivery of these programs (Taylor, Angel, Nyanga, & Dickson, 2017; The Department of

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Health, 2015). Simulation in nursing and midwifery education provides a platform for students to acquire skills and gain "hands-on" experience while ensuring that no compromise is made to patient safety (Aggarwal et al., 2010; Park, Conway, & McMillan, 2016; Rudd, Freeman, Swift, & Smith, 2010). For nursing and midwifery education, simulation has become indispensable as an alternative to hands-on experience with real-life patients. In some countries, clinical simulation incorporates between 13% and 50% of clinical hours for nursing students (Hayden, Smiley, Alexander, Kaardong-Edgren, & Jeffries, 2014; Sullivan et al., 2019).

Key Points

- Vulnerable groups, such as pregnant women, that cannot be utilized as simulated patients limit opportunities for students to practice clinical examination in simulation.
- The Wearable Simulated Maternity Model provides a cost-effective and realistic alternative that can be worn by simulated patients and enhances fidelity and student ability to practice performing examinations.
- Sharing of teaching innovations contributes to a best practice network in simulation.

Simulation has been proven to be effective in acquiring skills necessary for clinical practitioners (Hallenbeck, 2012; Sullivan et al., 2019) and to assist in increasing staff confidence and competence (Hommes, 2014). As Cooper et al. (2011) concluded in their literature review, although there is no evidence simulation should replace clinical practice, it is clearly beneficial for learning midwifery skills, especially where cases of clinical practice are rare, such as obstetric emergencies. Simulation can be used to address the current environment for trainees where there is an emphasis on patient safety, reduced clinical caseload, and limited work hours (Ennen & Satin, 2010).

The purpose of this methods study is to share the development of an innovative resource for use in immersive simulation that can be worn by simulated patients, simulate pregnancy, and provide midwifery students with opportunities to practice assessment skills. The Wearable Simulated Maternity Model provides a cost-effective and realistic alternative that, when worn by simulated patients, enhances fidelity and student ability to practice performing examinations.

Simulation Fidelity

Ethical issues and the inability to involve vulnerable groups, such as pregnant women, in simulation and/or reproduce the physiological body changes of pregnancy when simulated patients are used pose significant barriers to implementing simulation. High-technology birthing simulators are expensive (Lapkin & Levett-Jones, 2011) and fail to provide realistic therapeutic clinical encounters. The need to resource and support staff in the use of simulation equipment may present further obstacles to designing and implementing authentic clinical scenarios in simulation. As a result, creating a high-fidelity scenario can be challenging (Onello & Regan, 2013). According to Brady, Bogossian, and Gibbons (2015), using inexpensive, medium- to high-fidelity tools can significantly enhance learning outcomes for midwifery students. However, they found that there is a paucity of literature addressing the effectiveness of simulation fidelity in midwifery education (Brady et al., 2015).

A study conducted by McKenna et al. (2011) found that there are limitations on the use of simulation in midwifery education because of low levels of realism in manikins. The

Table Equipment and Supplies Required to Assemble the Wearable Simulated Maternity Model

Equipment	Notes
Fetus—manikin doll	Manikin with cloth torso and limbs is most suitable as it allows limbs to be folded into position and enhances fidelity for palpation.
Support shorts or control garment	Knee-to-chest style is recommended.
Sewing machine	Required to make adjustment to support shorts/control garment
Iron-on mending material	To strengthen gusset in the crouch of the support shorts/control garment.
Silicon vaginal examination (VE) box inners	Fetal Monitoring and Labour Progress Mentone Educational Centre™ kit is recommended. The silicone model will need to be removed from the VE box before inserting into the gusset of the support shorts/control garment.
Digital voice recorder	Small voice recording device required
Tennis ball	Used to form the skull of the fetus which will sit inside the VE part task trainer to facilitate examination of cervical dilation.
Sharp cutter or pen knife	
Beige medical glove	Used to imitate the scalp of the fetus
Beach ball	This replicates the uterus—encapsulates the fetus. Air or water replicates amniotic fluid and enhances the fidelity of palpation.

Figure 1 Support shorts/control garment modification.

study highlighted a need for more research into how varying levels of simulation fidelity impact educational outcomes. Brady et al. (2015) found that progressive and medium-fidelity simulation produce better outcomes among students. In their qualitative phenomenological study, Deegan and Terry (2013) found there was a high level of acceptance among participants in real-time simulation as it helped them develop the knowledge and skills necessary to manage obstetric emergencies. Several studies have suggested that further research is needed to explore if effective simulation results in improved patient outcomes (Aggarwal et al., 2010; Lapkin & Levett-Jones, 2011).

The national health workforce agency, Health Workforce Australia, conducted a review of the use of simulated learning environments across nursing curriculum in Australia. They recommended collaboration and sharing of resources between facilities and faculties to contribute to the development of a best practice network (Rudd et al., 2010). Similarly, Fox-Young et al. (2012) suggest that the

Figure 2 Recording of fetal heartbeat.

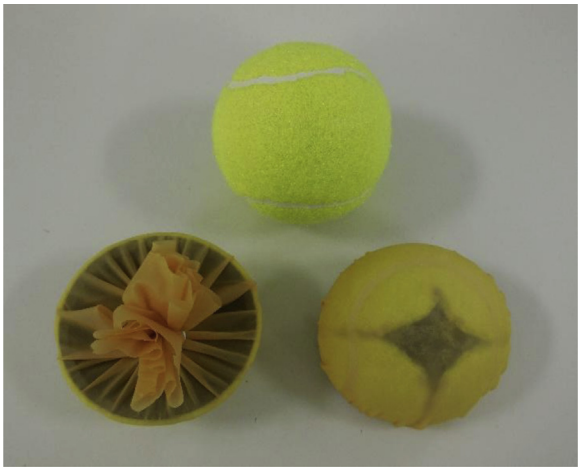

Figure 3 "Fetal skull" creation.

acceptance and uptake of simulation in midwifery education would be more prevalent if there were more collaboration and sharing in development and the use of resources.

The following innovative resource is thus presented as a simple, cost-effective model that can be replicated for undergraduate midwifery simulation. A summary of student evaluation results of simulation utilizing the device is included.

Methods

The use of simulated patients in midwifery simulation is limited because of the need for realistic physiological presentation that reflects body changes in pregnancy and an inability to perform real-life examinations. This is addressed when the Wearable Simulated Maternity Model

Figure 4 Placement of the doll (fetus) and recorder within the beach ball.

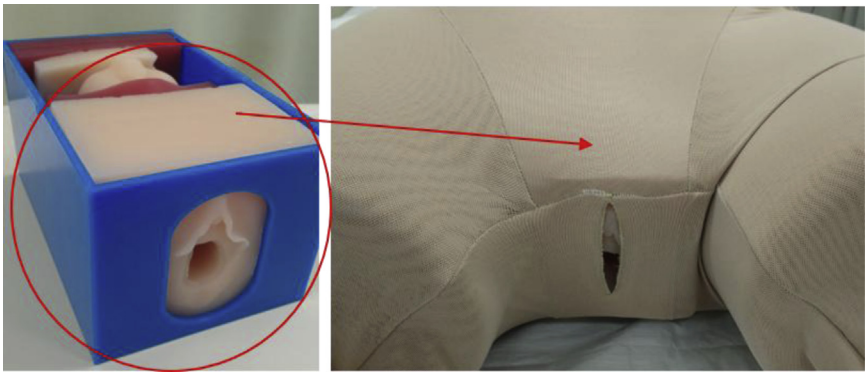

Figure 5 Placement of silicone inner from vaginal examination box into the support shorts.

apparatus, which replicates the pregnant abdomen, is worn by a simulated patient and enables students to palpate fetal position, perform a vaginal examination (VE), and listen to the fetal heart.

Building and Assembling the Wearable Simulated Maternity Model

To make the Wearable Simulated Maternity Model, follow the 12-step procedure outlined below. Photographs have been provided to add clarity and illustrate the development procedure and assembly of equipment. The equipment required is outlined in Table. This consists of a fetus-sized manikin doll, support shorts, sewing machine, iron-on mending material, silicon VE box, digital voice recorder, tennis ball, knife, beige medical glove, and a beach ball.

To Make the Model

Step 1. Reinforce the crotch of the support shorts/control garment with iron-on mending material and sew in place.
Step 2. Make a large button hole about 9 cm long to match VE part task trainer box inners to make provision for an opening.
Step 3. Unpick a small section of hem at top and thread through a draw string to make an opening to replicate the entrance to the vagina. Figure 1 illustrates the support short/control garment modification.
Step 4. Make a recording of a fetal heartbeat. Use a digital voice recorder and record the sound from a midwifery palpation part task trainer on full volume. Figure 2 illustrates recording of the fetal heart sound recording. This should be recorded for at least 30 minutes to avoid the recording stopping midway through the scenario.
Step 5. Make the ''fetal skull'', cut a tennis ball into half, remove a triangle or diamond shape of felt covering on the ball to replicate the fontanelles. This will enable students to practice feeling for the fontanelles when undertaking a VE.
Step 6. Cover the tennis ball with the beige medical glove or any stretchy smooth waterproof material to replicate the fetal scalp, as shown in Figure 3.
Step 7. Partially inflate the beach ball. Air or water can be used to simulate the uterus and amniotic fluid. Punch the beach ball on itself to form a cavity.

Assembly

Step 8. Position the doll on the actor's abdomen in the desired fetal position. Tuck in the voice recorder within the folds of the doll (see Figure 4), taking care to position the buttons so they will not be accidently activated.
Step 9. Place the partially inflated beach ball over the doll. Add or remove air in the beach ball to achieve the desired firmness of the abdomen (see Figure 5).

Figure 6 Placement of apparatus.

Figure 7 Cover with maternity clothes.

Step 10. Have the simulated actor pull on the modified support shorts/control garment.
Step 11. Place the simulated fetal skull in the VE silicone inner and carefully slip this into the crotch area of the modified support shorts (see Figure 6).
Step 12. Cover with maternity clothes (see Figure 7).

Before use, actors are prepared for simulation by midwifery faculty, introduced to the scenarios and instructed regarding history and presentation. Placement of the fetus and other parts of the apparatus is overseen by faculty. Once used and dismantled, washing the support shorts/control garment is easily undertaken following the manufacturer instruction. This allows safe use by multiple users (simulated patients).

Apparatus Evaluation

Overall, the learning environment is safe and provides students with unique opportunities to develop and improve their practice. The use of the apparatus allows measurement of the fundal height, palpation of the fetal position, and assessment of the fetal heart rate and cervical dilation. The use of the apparatus is suitable for simulation scenarios addressing antenatal assessment and assessment of early labor and monitoring mother and fetus during labor.

A validated survey was conducted with participating midwifery students (n = 81) using the Satisfaction with Simulation Experience Scale (Levett-Jones et al., 2011; Cronbach's alpha coefficient 0.78). Using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), the survey evaluated simulation learning experience, asking 24 questions addressing three categories. These were Debrief and reflection, critical thinking, and clinical reasoning and clinical learning.

The survey found an overwhelmingly positive response to the simulation using the Wearable Simulated Maternity Model. Mean scores were high (>4.87) with a standard deviation of 0.44. Ninety six percent (n = 78) of students either agreed or strongly agreed that the simulation felt real, helped them apply skills, and prepared them for clinical placement. All participants agreed the simulation was a valuable learning experience and that the simulation experience felt "a lot like being on practicum."

Students enjoyed the authentic immersive approach to midwifery simulation using real people to practice clinical and communication skills with, rather than manikins or using part task training models. Feedback included comments about the hands-on approach to learning such as: "The hands-on learning is a very constructive way of learning for myself." Students found that the simulations tested their knowledge and identified gaps on which they could work: "I found simulations very useful. They really tested my knowledge and I was able to identify what aspects I needed more work on." While some students felt quite challenged initially with the thought of completing an immersive simulation experience, they felt it was an enjoyable experience: "Really enjoyed simulation. Real

life practice without the consequences. Very scary going in, but worth it.''

Discussion

The simulation proved to be both realistic and cost-effective (<$AUD50); this largely used general items already in stock. While the simulation is high fidelity, it was simple to implement with fast installation and removal and was adaptable to different scenarios and actors. The apparatus is easily adapted to situations where more complex scenarios and authentic simulations are required, such as transverse or breech presentations, and managed with placement of the doll. The use of the Wearable Simulated Maternity Model provides students with the opportunity to practice skills in a safe environment with just-in-time feedback to improve their confidence in woman-centered care.

Conclusions

The Wearable Simulated Maternity Model has proven to provide a high-fidelity, low-cost, and simple to implement simulation experience. Most importantly, the implementation of this model in a student simulation scenario showed a notable impact on student learning and engagement. These outcomes suggest this simulation method increases fidelity and has the potential to increase clinical preparedness for midwifery students and as such would be a valuable resource for undergraduate programs.

The authors encourage shared use of simulation innovation such as this to improve collaboration and achieve best practice.

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