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Simulation training improves resident physicians' confidence in managing first trimester bleeding in the emergency department

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Abstract: First trimester bleeding is commonly encountered in pregnancy and can be potentially life-threatening. Simulation training provides an ideal opportunity for resident medical learners to improve clinical knowledge and gain confidence in managing life-threatening causes of first trimester bleeding in a realistic but safe clinical environment. The objective of this study was to assess the effectiveness of simulation in improving family medicine residents' confidence and knowledge in identifying and managing first trimester bleeding in the emergency department (ED). The intervention was a two-hour educational simulation focusing on management of unstable first trimester bleeding. Twenty-one family medicine residents (67% female) at the University of Toronto participated in the simulation and completed pre- and post-simulation questionnaires assessing their confidence and knowledge in management of first trimester bleeding. This study demonstrates that simulation training improves resident physicians' confidence in managing first trimester bleeding in the ED. Additionally, it improves their objective history taking skills. Post-graduate medical programs should consider developing structured simulation, particularly for high-yield clinical cases residents may not otherwise have acute exposure to and are required to be competent in managing.

Keywords: Emergency Medicine; First Trimester Bleeding; First trimester Pregnancy; Simulation Training

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1. Introduction

Residency is a critical learning period for post graduate learners to be exposed to high yield clinical presentations. Family physicians are considered generalists, and must be competent in addressing common life-threatening presentations such as first trimester bleeding. First trimester bleeding is encountered in up to 25% of all pregnancies, with half of these resulting in miscarriage (1). Following, determining if a miscarriage is occurring, a potentially life-threatening condition if missed, is a top reason women report seeking care in the emergency department (ED) (1). Although some research exists focusing on obstetrics and gynecology residents' identification and management of first trimester bleeding (2,3), there is no extant literature assessing this topic for family medicine residents. Simulation training can provide an ideal opportunity for resident learners to improve clinical competence and confidence, increase patient safety and outcomes, and reduce health care costs in the long run (4,5). The objective of this study was to assess the effectiveness of simulation in improving family medicine residents' confidence and knowledge in identifying and managing first trimester bleeding in the emergency department.

2. Methods

2.1. Study design

The two-hour educational session consisted of a presentation on management of acutely unstable first trimester bleeding, followed by a simulation session with the clinical case being a missed abortion. The session was led by a faculty emergency and family medicine staff physician at Michael Garron Hospital, University of Toronto, Canada. Twenty-one family medicine residents (67% female) participated in the simulation and were recruited based on a convenience sample of the residents who attended mandatory dedicated teaching that day. The residents were randomly split into groups of approximately 4-6 residents for the simulation. The residents were aware the scenario would be based around an advanced cardiovascular life support (ACLS) theme (life-threatening airway, breathing, circulation or severe disability scenario), but no further clinical details were provided. At the start of the simulation, residents were presented with the clinical scenario and instructed to assess the (standardized) patient. The scenario was a twenty-seven-year-old female patient presenting at eight weeks gestation to the ED with vaginal bleeding and light-headedness. Residents were

Table 1 Analysis of gains in participant clinical confidence in all areas studied

Clinical confidence	Pre-sim Mean	Post-sim Mean	Wilcoxon signed rank test
Management	2.76 ±0.89	3.29 ±1.01	z=2.02, P=0.04
History taking	4.10 ±0.83	4.05 ±0.74	z=0.22, P=0.83
Physical exam	3.29 ±0.96	3.48 ±1.03	z=0.66, P=0.51
Differential Dx	3.48 ±0.75	3.71 ±0.64	z=1.07, P=0.28

Dx: Diagnosis; Post-sim: Post-simulation; Pre-sim: Pre-simulation

Table 2 Analysis of gains in participant clinical confidence in all areas studied

Clinical knowledge	Number Correct responses pre-sim	Number correct responses post-sim	Fischer's exact test
Management	20	20	P=1.00
History taking	11	19	P=0.02
Physical exam	17	19	P=0.66
Differential Dx	14	14	P=1.00

Dx: Diagnosis; Post-sim: Post-simulation; Pre-sim: Pre-simulation

instructed to take a focused history, conduct an appropriate physical exam, and proceed with their investigation and management strategies. During the encounter, the patient became progressively more light-headed, hypotensive and tachycardic, and had a syncopal episode. Investigations revealed that the patient was profoundly anemic, and the residents must call a "code transfusion" in realizing the patient urgently needs blood. Emphasis was placed on the patient's airway, breathing and circulation throughout the prompts provided to residents, and several prompts were given that copious vaginal bleeding was occurring throughout the encounter. A post-simulation debriefing was held with the staff physician for each group, with relevant clinical points and management strategies discussed.

2.2. Data collection

All residents who attended, completed an eight-item pre- and post-simulation questionnaire. The outcome was resident physicians' confidence and knowledge in identifying and managing first trimester bleeding. Confidence was measured with four different clinical outcome questions (history taking, physical exam maneuvers, diagnosis and management) using a 5-point Likert-type scale. Similarly, knowledge was measured in the same four categories with multiple choice questions (one per category). Secondary outcomes included identifying learning opportunities most helpful for increasing learner confidence in management, measured with an open-ended check-box question.

2.3. Statistical analysis

Pre- and post-simulation descriptive statistics were analyzed, and paired questions were assessed using the Wilcoxon signed rank test (Likert-type questions) and Fisher's Exact tests (multiple choice questions). We obtained ethics approval from Michael Garron Hospital (NR-355) for the study, and informed consent was obtained from all participants.

3. Results

Participant confidence significantly increased for clinical management (P=0.04), but not for history taking, physical exam skills, or developing a differential diagnosis (Table 1). In terms of knowledge, history taking significantly improved post-intervention (P=0.02), but not the other three categories (Table 2). For the secondary outcome measure,19/21 participants indicated that simulation was a useful learning opportunity to increase their ability to manage first trimester bleeding in the emergency department.

4. Discussion

This study demonstrates that using simulation training can increase resident physicians' confidence in managing first trimester bleeding in the ED. Further, it can objectively improve their history taking skills. Considering the current need for family medicine graduates with a broad scope of practice, implementing simulation training into family medicine curricula may improve residents' confidence in management of life-threatening emergencies such as first trimester bleeding. Simulation training has become a key component of emergency medicine medical education, and expanding this teaching strategy to other specialties expected to know common lifesaving skills should be considered as a preferred teaching tool. This method of training is a safe environment for both patients and medical learners, and can be more cost effective in certain scenarios (6,7). Additionally, some research shows that it may be more effective than more traditional, didactic, methods of teaching used in the education of healthcare providers (8–10).

Further, emergency medicine is utilizing simulation for learners to gain experience and proficiency in rare pathology. Considering that both family and emergency medicine physicians are expected to be generalists, if physicians are working in an emergency setting, they are required to be proficient in all emergency life-saving and stabilizing procedures. Simulation training allows learners to gain experience

and skills in these rare scenarios (i.e. pericardiocentesis), so if rare pathology presents in the ED throughout their career they will be proficient in its management, whereas otherwise in their training they may never have come across this presentation (6,11,12). Likewise, our simulation could have gone a step further in incorporating speculum and vaginal physical examination maneuvers for further clinical competence, and we would recommend those replicating this in the future to consider that component if mannequins and supplies allow for it.

Ensuring an optimal simulation environment with stated goals and objectives is key to the success of the education session. Our objectives were pre-set, including measurement of our confidence and knowledge outcomes, with our simulation specifically designed to target these goals. In our session, we ensured that it was explicitly stated before the simulation that this is a safe learning environment. Anecdotally, we found that residents working in groups with their known and trusted peers also provides an environment where they feel safe, supported and able to openly acknowledge their knowledge gaps. Per Davis and Warrington's guidelines for simulation training in emergency medicine, we also ensured adult learners were treated as respected and intelligent peers, encouraged residents to take responsibility for their learning, optimally challenged their intellect and skill level, ensured all learners were actively engaged in some role during the simulation session, and strongly encouraged feedback at the end of the sessions (6). Lastly, we ensured debriefing, as it is the cornerstone of successful simulation programs (13).

5. Conclusion

In summary, this study demonstrates that simulation is an effective tool to increase resident physicians' confidence in managing first trimester bleeding. Although our study demonstrated increased confidence, more robust competency measures could be assessed in the future, as well as confidence retention. Larger sample sizes across other relevant medical specialties (i.e. emergency medicine residents, obstetrics and gynaecology residents) could also be implemented.

6. Limitations

Future studies are needed to determine translation into clinical practice as well as patient outcomes. Overall, implementing structured simulation into residency curricula to supplement other forms of traditional learning may be a valuable educational tool to provide residents with early exposure that they may need to manage potentially life-threatening scenarios in independent practice.

7. Declarations

7.1. Acknowledgement

None.

7.2. Authors' contribution

All authors contributed to the conception, development, analyses, draft and editing of the manuscript.

7.3. Conflict of interest

The authors declare that they have no conflicts of interest.

7.4. Funding

None.

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