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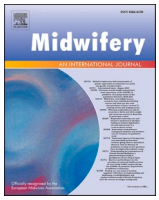

Research Article

Enhancing the competencies of obstetrical nurses and midwives in high-risk pregnancy management through simulation-based training in Lao people's democratic republic: A pilot study

Ratree Sirisomboon [a], Sasitara Nuampa [b,*], Jarunee Leetheeragul [a], Metpapha Sudphet [a], Kanjana Pimol [a], Sudhathai Sirithepmontree [b], Lamngeun Silavong [c]

[a] Obstetrics and Gynaecological Nursing Division, Department of Nursing Siriraj Hospital, Faculty of Medicine, Siriraj Hospital, Bangkok, Thailand
[b] Department of Obstetric and Gynaecological Nursing, Faculty of Nursing, Mahidol University, Bangkok, Thailand
[c] Department of Nursing, Mahosot Hospital, Vientiane Prefecture, Laos

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ABSTRACT

Background: Simulation-based training has been widely used as a valuable strategy for learning and evaluating clinical skills at different levels of nursing and midwifery education. The impact of simulation training on intensive management for high-risk pregnancy in a low-resource setting has been limited.
Aim: To examine the effect of simulation-based training with low-fidelity mannequins on obstetrical nurses and midwives' knowledge, attitude, and skills for high-risk pregnancy management in a low-resource setting.
Method: During September 2023, twenty-five obstetrical nurses or midwives who worked in five tertiary public hospitals in Vientiane Prefecture participated in the three-day training workshops for intensive management in high-risk pregnant women and newborns that used a simulation-based training approach integrating problem-based learning. The evaluated criteria of knowledge, attitudes, and skills pre- and post-test scores were statistically compared.
Findings: Workshop trainees demonstrated an increase significantly in knowledge for high-risk pregnancy management ($p = 0.012$), attitude toward high-risk pregnancy management ($p = 0.000$), and attitude toward simulation-based training design ($p = 0.002$). The clinical skills were used on the simulation performance checklist, and the pre-posttest gain in overall performance scores had a statistically significant difference ($p = 0.000$). The mean score of postpartum hemorrhage management skills was 11.48±2.23, which increased the highest score among all skills.
Conclusions: The simulation-based training in high-risk pregnancy management improves the knowledge, attitude, and skills of nurses and midwives in low-resource settings. Next steps include direct observation of trainees in the clinical setting to assess their competence in ensuring patient safety, achieving positive pregnancy outcomes, and enhancing satisfaction.

Introduction

A high-risk pregnancy refers to pregnancies in which the mother or the fetus has an increased risk of complications compared to uncomplicated pregnancies. Besides, high-risk pregnancy affects the health of 3 %–10 % of pregnant women and their fetus and increases perinatal and neonatal mortality (Berek, 2020). Especially maternal mortality as a result of complications during and following pregnancy and childbirth, such as postpartum hemorrhage and pre-eclampsia (World Health Organization, 2023). About 287,000 women died during and following pregnancy and childbirth in 2020. Almost 95 % of all maternal deaths occurred in low- and lower-middle-income countries in 2020 (World Health Organization, 2023). The maternal mortality rate (MMR) in low-income countries in 2020 was 430 per 100,000 live births, versus 12 per 100,000 live births in high-income countries. Regarding to achieve Sustainable Development Goal 3, reducing health inequities and improving health outcomes in low-income countries should be supported the quality of health services (United Nations, 2016; World

* Corresponding author.
E-mail address: Sasitara.nua@mahidol.edu (S. Nuampa).

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Health Organization, 2013).

Lao People's Democratic Republic (PDR), a country of 7.5 million people in Southeast Asia, has the highest rate of MMR was 126 per 100,000 live births in 2020, while the global MMR goal is less than 70 per 100,000 births by 2030 (The World Bank, 2023). In addition, the under-five mortality was reported 44 per 1000 live births in 2020, while the SDGs target 3.2 aims to end the preventable death of under-five mortality and to lower at least as low as 25 per 1000 live birth for all countries (United Nations Children's Fund, 2021; World Health Organization, 2023). The reproductive, maternal, newborn, child, and adolescent health (RMNCAH) 2016-2025 is a priority and an essential component of the national strategy and action plan to improve healthcare quality (Ministry of Health, 2022). Midwives and nurses play significant role in providing primary RMNCAH services (Homer et al., 2014). Priority was given to midwives because of the national focus on improving the availability of skilled birth care to reduce the high maternal and newborn mortality. Thus, Lao PDR invested in midwifery education, through developing and strengthening midwifery diploma education and establishing a midwife association (Ministry of Health, 2023; Lao Midwife Association, 2020; United Nations Population Fund, 2022). However, gaps are widespread in their skills and performance, resulting in uneven care quality. To narrow this gap for maternal and child health, it is crucial to empower midwives and nurses through comprehensive training to improve quality of service (Campbell et al., 2013; Cometto and Witter, 2013; Kubota et al., 2023).

Competent nurses are key contributors to maintaining safe and effective health care services by integrating knowledge, skills, and attitudes that enable them to adapt to dynamic health environments (Fukada, 2018). Similarly, core competencies of midwives utilize evidence-based midwifery knowledge, skills, and professional judgement to provide the necessary support, care and advice during pregnancy, labor, and the post-partum period (World Health Organization, 2018). The capacity of health care providers, particularly obstetrical nurse and midwives is necessary to ensure the quality of maternal healthcare services. Most of the typical obstetric complications can be addressed proactively before reaching emergency status, and nearly all can still be effectively treated even if they escalate to emergency situations (United Nations Population Fund, 2023). Care provided by skilled health professionals before, during, and after childbirth can save the lives of women and newborns (World Health Organization, 2023). There have been many studies on perinatal nursing interventions for high-risk pregnancies. The use of high-quality prenatal nursing interventions for high-risk pregnant women improved pregnancy outcomes and reduced the occurrence of maternal and infant complications (Majella et al., 2019). However, nursing management in high-risk pregnancies and obstetric emergencies is a highly professional and complicated task. The previous study found that healthcare lacked skilled birth attendants, which increased the risk of maternal mortality (Randive et al., 2013). According to India, healthcare providers had suboptimal knowledge of, and practices for, screening common high-risk conditions and assessing complications in pregnancy. The staff mentioned the inability to manage the childbirth of women with high-risk conditions and complications (Singh, 2019).

Simulation-based training has been widely used as a teaching approach to improve patient safety and quality of care (World Health Organization, 2018). It is an effective technique for imparting knowledge and evaluating clinical skills at various levels of nursing and midwifery education (Hegland et al., 2017; Park et al., 2016). Improving clinical performance can be achieved through both high and low fidelity simulated learning experiences. Fidelity refers to the realism of the simulated environment (Bogossian et al., 2010). Previous studies have found that high fidelity simulation increases knowledge, confidence, and satisfaction among nurse practitioner students (Warren et al., 2016). Additionally, medium fidelity simulation results in better technical and non-technical skill outcomes compared to low fidelity simulation among midwifery students (Brady et al., 2015). A systematic review of the literature demonstrates that simulated learning of midwifery skills offers educational benefits, enhancing skills, confidence, and non-technical performance (Cooper et al., 2012). According to an Australian midwifery survey, simulation was used to assess various learning outcomes, most commonly competence (78 %), skills performance and clinical judgement (67 %), attitude (56 %), and self-efficacy (11 %) (Bogossian et al., 2012). Recent reviews of maternity services have highlighted an urgent need for midwifery practitioners to develop both technical and non-technical skills to ensure the direct safety of mothers and babies within the healthcare system (Department of Health and Ageing, 2011). Furthermore, simulation-based training has been found to increase emergency obstetric care in low-resource settings, while the application of specific skills varies (Das et al., 2016; Evans et al., 2014; Nelissen et al., 2014; Walton et al., 2016). In addition, clinical reasoning capacity is a core competency required of all nurses. It improves by allowing people to reflect on the problem-solving process or to incorporate clinical judgment into debriefing (Cato et al., 2009).

However, the impact of simulation training on nursing management and clinical problem-solving in high-risk pregnancy situations during the antepartum and intrapartum periods within low-resource settings remains limited, particular at the postgraduate training. Based on the risk incidence of maternal mortality in Lao PDR, this study developed six sessions of simulation-based training for obstetrical nurses and midwives to manage high-risk pregnancy conditions, such as gestational diabetes mellitus, pregnancy-induced hypertension, postpartum hemorrhage, prolapsed cord, shoulder dystocia, and neonatal resuscitation. Therefore, the aim of this pilot study was to determine the effect of simulation-based training on obstetrical nurses and midwives' knowledge, attitude, and skills for high-risk pregnancy management in a low-resource setting. The study's use of simulation-based training to improve scientific, technical, and nontechnical skills may result in a capacity-building effect on healthcare providers that further reduces maternal mortality.

Methods

Participant recruitment

During September 2023, a pilot study with a single group pretest-posttest design and convenience sampling was conducted at large tertiary hospital in Vientiane Prefecture, Lao People's Democratic Republic (PDR). Study participants were nurses or midwives ($n = 25$) working in the obstetrical departments of five tertiary hospitals in Vientiane Prefecture, Lao PDR. Five obstetrical nurses or midwives were selected from each hospital (Whitehead et al., 2016). The eligible obstetrical nurses or midwives have worked for at least five years and completed the online training (40 hours) in the project "Intensive Training for Continuing-Care Systems for High-Risk Pregnancy" from February to March 2023.

Pilot study design

In the end of September 2023 participants completed 12-hours within three days consisted of four simulation-based training and two simulation problem-based workshops (1.5-3 hours each) in learning resource center environment focused on basic and intensive managements in high-risk pregnancy, obstetric emergency, and neonatal resuscitation topics (Table 1). The workshop consisted of a total of thirteen clinical procedures (basic skills), eleven clinical case scenarios, and worksheets. At the start of the Basic Workshop, participants completed a 10-item demographics and work experiences questionnaires. Participants reported on their attitudes and knowledge in clinical management for high-risk cases **(Supplement 1)** prior to the Basic Workshop (day 1), and after the Intensive Workshop (day 3). Also, the basic and advance skills were assessed in each station of workshop in pre-post clinical skills where participants took turns role-playing as

Table 1
The simulation-based training design for high-risk pregnancy' nursing management.

Topic	Sessions	Training method	Duration (hour)	Participants ($N = 25$)
Gestational diabetes mellitus (GDM)	1. Advice for diet control 2. Medication management 3. Hypoglycemia and hyperglycemia management	Simulation Problem-based Learning	2	6 groups (n= 4-5 per group)
Pregnancy-induced hypertension (PIH)	1. Screening and health education 2. Medication management 3. Risk management	Simulation Problem-based Learning	2	6 groups (n= 4-5 per group)
Shoulder dystocia	1. Basic skills (McRoberts maneuver, Suprapubic pressure) 2. Intensive skills	Simulation-based Learning	1.5	4 groups (n= 6-7 per group)
Prolapsed cord	1. Basic skills (Maternal positions, Filling of maternal urinary bladder, Fetal resuscitation) 2. Intensive skills	Simulation-based Learning	1.5	6 groups (n= 4-5 per group)
Postpartum hemorrhage (PPH)	1. Basic skills (Medication management, Balloon Tamponade) 2. Intensive skills	Simulation-based Learning	2	4 groups (n= 6-7 per group)
Neonatal resuscitation	1. Basic skills (Initial steps of newborn care, Positive-pressure ventilation, Endotracheal intubation, Chest compression, Medication management) 2. Intensive skills (Term and Preterm)	Simulation-based Learning	3	3 groups (n= 8-9 per group)

leader and team members. The Ethics Committee of the Mahidol University Muti-faculty Cooperative IRB Review, Thailand and National Ethics Committee for Health Research, Vientiane Capital, Lao PDR approved the study protocols. Before the start of the study, obstetrical nurses and midwives were fully informed about the intervention details and signed informed consents.

Workshop development

Generally, in these obstetrical nurses or midwives in Lao PDR, the content of clinical management for high-risk cases was delivered through irregular events in order to update their knowledge without upskills in simulation-based team learning. According to the adverse outcomes in high-risk pregnancy were reported from five tertiary hospitals in the capital of Lao PDR where were high volumes of high-risk pregnancy. Six clinical practices were needed in professional skills which were developed in this study. As this pilot study, six simulation-based learning topics in the workshops were induced into the nurse and midwifery courses who working in the obstetrical department for upskills to professionals' intensive management high-risk cases during perinatal to postpartum and neonatal care.

The training workshop consisted of two simulation-based learning. Firstly, simulation problem-based learning was used in the workshop on management in diabetes mellitus in pregnancy and pre-eclampsia with four hours of activities. Secondly, the simulation-based training during obstetric emergencies in the intrapartum period, including shoulder dystocia, prolapsed cord, and postpartum hemorrhage, was completed within five hours. Finally, management in neonatal resuscitation in preterm and term infants through simulation-based training was conducted within three hours, as shown in Table 1.

We had the standard of clinical simulation design and problem-based design, which were separated into three sessions of introduction, simulation activities, and debriefing about key points for enhancing future performance, and feedback was given to them regarding strengths and weaknesses (Jeffries et al., 2016; Tanner, 2006; World Health Organization, 2018). For the nursing management in perinatal period of diabetes mellitus and preeclampsia/eclampsia, the participants completed a problem-based learning worksheet and free response questions to help guide the participants through the content of the workshop. While the four simulation-based learning, participants were assessed via observation forms.

The research team scheduled a meeting with national healthcare providers' experts in the obstetric department to prepare and discuss the available resources for low-cost simulation. The simulation materials were prepared to relate with each session, including a food exchange card and a card of appropriate foods for managing hypoglycemia in GDM; intravascular fluids and injectable medications were employed for water filling instead of actual medication to learn drug management; obstetrical emergencies were simulated using standardized patients combining pelvic part models; prolapsed cord management was simulated using Foley's catheter and urine bag to manage bladder filling; and neonatal resuscitation sessions included plastic models of monitor equipment machines and infant dolls.

The clinical practices content in a high-risk pregnancy workshop was designed based on international health recommendations and guidelines (American College of Obstetricians and Gynecologists, 2023; Cunningham et al., 2018; World Health Organization, 2017). Evaluation materials for the basic and intensive workshops were prepared by five nurse-midwife instructors specializing in antenatal, intrapartum, and postpartum care. Three obstetric physicians, experts in developing midwifery courses for high-risk pregnancy management in tertiary hospitals, assisted with content validation to ensure accuracy and readability. Nurse-midwife instructors held meetings to discuss and revise vital recommendations in collaboration with nurses and midwifery guidelines to enhance program content and assessment validation.

The principal investigator was present at each workshop to facilitate the study and six instructors, a nurse-midwife led the workshops. Nurse-midwife trainers in this study who had trained in simulation-based learning and problem-based learning in all situations were nurse-midwife specialists with clinical nursing education and working experience of at least 10 years managing high-risk pregnant women. We discussed and practiced step-by-step of the simulation guidelines for practicing, teaching, and debriefing for a four-hour session and provided practices training guidebook **(Supplement 2)**. This simulation-based training was designed based on the NLN Jeffries Simulation Theory (Fig. 1). The outcomes presented in the framework are proposed to be influenced by the design and implementation of the simulations (Jeffries et al., 2016).

Training evaluation method

Pre-test and post-test were taken from obstetrical nurses and midwives before and after the project. The pre-test and post-test were conducted in the form of self-administrative questionnaires (attitude and knowledge). The observational checklists were assessed for clinical skills by two assessors at the end of each simulation in the six clinical skills.

This outcome measure of this study contained four instruments, including 1) attitude toward high-risk pregnancy management; 2) attitude toward simulation-based learning for high-risk pregnancy

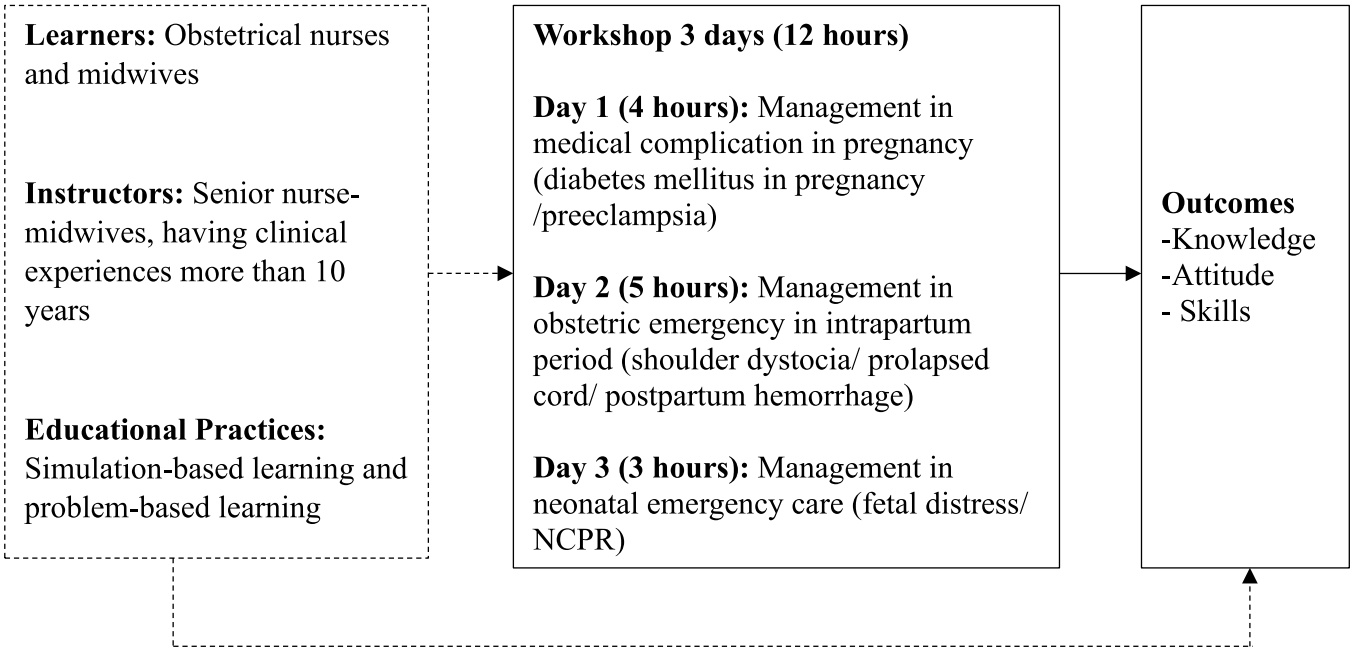

Fig. 1. The simulation-based learning in this study

management; 3) practical knowledge for high-risk pregnancy management; and 4) management skills for high-risk pregnancy care. The total of 6 items of attitude toward high-risk pregnancy management and 6 items of attitude toward simulation-based learning with a 5-point Likert scale (1 = disagree to 5 = extremely agree) were measured before and after the program, as well as practical knowledge for high-risk pregnancy management, which contained 20 items of GDM (item 1-5), PIH (item 6-10), PPH (item 11-13), shoulder dystocia (item 14-15), prolapsed cord (item 16-17), and neonatal resuscitation (item 18-20) with 3 scales (true, false, and unsure) with a score range of 0–20.

For observational form, the 54 items of a simulation performance checklist consisted of 4 sessions, including 1) management skills for high-risk pregnancy during the antenatal period 12 items (GDM, PIH); 2) management skills for obstetric emergencies 20 items (shoulder dystocia, prolapsed cord); 3) management skills for PPH 15 items; and 4) management skills for NCPR 7 items. The observation checklist measured three levels: 0 was did not perform or incorrect, 1 was somewhere perform, and 2 was correct perform, which had a range of 0-108 and 80 percent passing score.

The instruments' reliability in this study was tested before project initiation and presented all strong reliability: the Cronbach's alpha of attitude toward high-risk pregnancy (0.82) and attitude toward simulation-based learning (0.86), and the KR-20 coefficient of practical knowledge (0.91). Moreover, the interrater reliability of a simulation performance checklist was tested with two assessors at the same time in ten simulations, and we discussed adapting the observation checklist before use in the study. The kappa coefficient of a simulation performance checklist was 0.94.

Data analysis

Descriptive statistics were used to analyze the data in SPSS version 20. Sociodemographic data were reported using descriptive statistics. Means and standard deviations were calculated for knowledge, attitude, and clinical skills scores. For normally distributed data, where the dependent variable was either at the interval or ratio levels of measurement, the dependent t test for paired samples was used. For the outcomes that are not normally distributed, nonparametric tests were used. The related-samples Wilcoxon signed-rank test in SPSS was used for statistical analysis where the data were not normally distributed, and the dependent variable was at least at the ordinal level of measurement. The Wilcoxon test is the nonparametric equivalence of the dependent t test and is used to compare data from two related groups with the same individuals in each group between two time points. Data missing for either the pre- or post-outcome were excluded from the analysis. P-value < 0.05 was considered significant.

Results

Twenty-five participants, who were obstetrical nurses ($n = 15$, 60.0 %) and midwives ($n = 10$, 40.0 %), participated in the high-risk pregnancy management simulation-based learning. Nearly half of them (44.0 %) were less than 30 years old, which was the average age of 33.92 years (SD 8.16). The mean ± standard deviation of working experience duration with high-risk pregnancy care was 9.47± 8.81 years. Most participants never attended high-risk pregnancy training (60.0 %), while almost (92.0 %) of them mostly intended to improve the quality of care in high-risk pregnancy in their setting, as shown in Table 2.

The mean and standard deviation of the overall attitude toward high-risk pregnancy management score and attitude toward simulation-based learning were significantly higher than the pre-posttest score (2.48 ± 1.92, p = 0.000; 2.72 ± 3.86, $p = 0.002$). Moreover, the mean score of practical knowledge for high-risk pregnancy management was significantly higher in the posttest, as presented in Table 3. In the evaluation of high-risk pregnancy management skills from problem-based and simulation-based learning, the mean score of postpartum hemorrhage management skills was 11.48 ± 2.23, which increased the highest score among all skills. The GDM and neonatal resuscitation management skills also had higher mean differences between pre-posttest scores of 2.52 ± 0.73 ($p < 0.001$) and 12.47 ± 0.94 ($p < 0.001$), respectively. Table 3 shows the details of the scores and the range of minimum and maximum points for each skill by nurses.

Discussion

Maternal mortality in Lao PDR is the highest in the Asia-Pacific region (United Nations Population Fund, 2023). The well-trained competence of the obstetrical nurses or midwives may prevent or

Table 2
Characteristics of participants (N = 25).

	N	%
Ages (year)		
< 30	11	44.0
30-40	9	36.0
>40	5	20.0
Working units		
Antenatal care unit	6	24.0
Delivery unit	6	24.0
Postpartum unit	1	4.0
Delivery and postpartum unit	12	48.0
Working experiences (year)		
< 10	12	48.0
10-20	9	36.0
21-30	3	12.0
>30	1	4.0
High-risk pregnancy management training experience		
Yes	10	40.0
No	15	60.0
Intention to improve quality of high-risk pregnancy's care		
Never	1	4.0
Rarely	1	4.0
Sometime	0	0.0
Mostly	17	68.0
Always	6	24.0

Table 3
Pre-and post-simulation training assessment (*N* = 25).

	Pre-test (mean ±SD)	Range	Post-test (mean ±SD)	Range	Mean difference ±SD	P-value
Attitude toward HRP nursing management	22.08 ± 2.77	18-28	24.56 ± 2.40	20-28	2.48 ± 1.92	<0.001
Attitude toward SBL	24.56 ±4.17	14-30	27.28 ±3.05	19-30	2.72±3.86	0.002
Knowledge for HRP management	14.84 ±2.72	8-19	16.56 ±1.36	13-19	1.72±3.17	0.012
Category of Skills						
Overall	60.24 ± 3.49	53-66	99.40 ± 2.37	95-104	39.16 ± 3.69	0.000
GDM	2.52 ± 0.73	2-4	12.47 ± 0.94	11-14	9.96 ± 1.18	0.000
- Diet control	0.44 ± 0.51	0-1	9.08 ± 0.95	7-10	8.64 ± 1.07	0.000
- Medicine management	1.00 ±0.00	1-1	1.48 ±0.50	1-2	0.48±0.51	0.000
- Symptom management	1.12 ± 0.33	1-2	2.00 ± 0.00	2-2	0.88 ± 0.33	0.000
PIH	5.84 ± 1.24	4-9	8.08 ± 1.49	5-10	2.24 ± 1.85	0.000
- Screening risk and health education	2.36 ± 0.75	1-4	3.44 ± 0.71	2-4	1.08 ± 0.95	0.000
- Medication management	2.40 ± 0.86	0-4	2.80 ± 0.91	1-4	0.40 ± 0.86	0.030
- Risk management	1.08 ± 0.40	0-2	1.84 ±.037	1-2	0.76 ± 0.59	0.000
Shoulder dystocia	13.36 ± 0.95	11-15	17.44 ± 0.71	16-18	4.08 ± 1.28	0.000
Prolapsed cord	15.48 ± 1.89	11-19	20.80 ± 0.91	18-22	5.32±1.28	0.000
Postpartum hemorrhage	16.76 ± 1.23	13-18	28.24 ± 1.61	26-30	11.48 ± 2.23	0.000
Neonatal resuscitation	6.48 ±0.77	6-8	12.28 ± 1.20	10-14	5.80 ± 1.19	0.000

Note. Difference was statistically significant between pre and post ($P < .001$); SD, Standard Deviation; HRP, High-Risk Pregnancy; SBL, Simulation-Based Learning; GDM, Gestational Diabetes Mellitus; PIH, Pregnancy Induced Hypertension.

reduce the risk of complications for women. The purpose of this pilot study was to examine the effect of simulation-based training with low-fidelity mannequins on obstetrical nurses and midwives' knowledge, attitude, and skills for high-risk pregnancy management in a low-resource setting. However, participants in this study had never participated in simulation-based learning in high-risk pregnancy treatment, which obtained their positive attitude with simulation design. After simulation was implemented, obstetrical nurses and midwives in this study demonstrated an increase in knowledge and attitudes toward high-risk pregnancy management following simulation, indicating simulation-based training as an effective learning method to improve intensive knowledge, which becomes an essential component for clinical competency, as well as a positive attitude, which improved confidence for work.

Simulation-based education has been identified as a valuable and effective learning tool for improving nursing competency required for quality nursing care with experiential learning through direct participation, iterative learning through repetition, and the application of nursing theories into practice (Felton et al., 2013) and showed the positive learning outcomes of simulation-based programs (Angelina et al., 2021; Kim et al., 2016). According to the previous studies, several trainings employed simulation-based training for nurses or midwives through maternal and child care, resulting in positive competencies (Kato & Kataoka, 2017; Rovamo et al., 2013; Tabatabaeian et al., 2018). The simulation of postpartum hemorrhage management in this study had the highest score of management skills compared to before and after training. Similarly, a study in Japan found that the simulation-training group had significantly higher performance scores than the group without training for the management of postpartum hemorrhage (Kato & Kataoka, 2017). However, maternal critical care simulation training of midwives in China showed significant improvements in the case scenarios simulating shoulder dystocia, amniotic fluid embolism, and eclampsia but not postpartum hemorrhage (Zou et al., 2023). Moreover, the midwife performance of the management of preeclampsia and eclampsia in the simulation educational group was higher than that of the blended and lecture groups, and the management performance could last two weeks after the training (Tabatabaeian et al., 2018). Regrading neonatal resuscitation simulation, midwife skills in neonatal resuscitation are essential for personnel involved in the care of newborns. A 1-day course could improve resuscitation skills. The more experienced the midwife, the better she passes the test (Rovamo et al., 2013). In addition, simulation-based learning in this study could improve obstetrical nurses and midwives' knowledge and attitudes toward high-risk management. The study by Kato and Kataoka (2017) found that a simulation training program had a significantly large variation in knowledge scores prior to and 1 month after training. The nursing process-based simulation of maternal and child emergency nursing care in clinical nurses in South Korea.

Nevertheless, this pilot study demonstrated replicable effects of simulation training in the nursing profession in low-resource settings. Unfortunately, in Lao PDR, as in many other countries around the globe, obstetrical nurses or midwives are in limited supply. There was a literature review on the effectiveness of simulation in low-resource situations that showed encouraging trends in terms of trainee satisfaction with improvement after training (Martinerie et al., 2018). In addition, a low-fidelity simulation intervention of active management in the third stage of labor showed a positive change in knowledge and skills immediately after intervention, and skills were highly retained even after six months of training (Angelina et al., 2021). However, the challenges of nurse educators in clinical nursing education in low-resource settings presented a key problem: a lack of nurse educators teaching practical skills effectively and facilitating the development of clinical competence (Salifu et al., 2022).

The obstetrical nurses and midwives in this study had to collaborate to practice as a team. According to the review literature, simulation-based team training in obstetric emergencies improves team members'

technical skills (Yucel et al., 2020). A team-based approach is desirable for time-critical management, which ultimately increases the quality of patient treatment and patient safety (Ilgen et al., 2013). The simulation-based team in obstetric emergencies may improve important patient outcomes, such as morbidity and mortality, through higher obstetrical nurses or midwives' competences. Moreover, previous studies showed that antenatal counselling and management among high-risk pregnancy were lacked for midwifery (Bogossian et al., 2012). This study applied the simulation problem-based learning into improve obstetrical nurses and midwives' knowledge, attitude, and necessary skills for diabetes mellitus and pregnancy induced hypertension. The problem-based learning is a learner-centered approach that allows nursing students to interact in small groups to improve their clinical skills and cognitive capacity (Sharma et al., 2023). Problem solving using case studies are able to encourage learners to gain awareness of their own knowledge and skills and applying this in new situations through integration of their prior knowledge (Sangestani et al., 2013).

This study has some limitations for generalizing the results since it focused on a limited area of nursing services with a limited number of nurses and a design without a control group. Moreover, this study's simulation design targeted on the risk occurrence of particular concerns in the Lao setting, which may have limited its generality to other contexts. However globally recommendations served as the foundation for the creation of the standard training. Some confounding factors, such as work experience, participants' ages, and basic nursing education, were not controlled, while the pre-test provided initial baseline information. Furthermore, this study developed assessments that align with relevant literature; however, the reliability of these tools was deemed acceptable (Souza et al., 2017). Regarding the strength of this study, this study designed the learning methods of problem-based and simulation-based learning about high-risk pregnancy through both technical and non-technical skills. Further research should be focused on the development of better design in scenarios and mentioned in specific skills in continuing care competence, which is important for high-risk pregnancy management and following long-term skills. Moreover, tailored for more diverse groups of nurses and midwives, we will verify the validity and reliability of the program.

Conclusions

Our pilot study highlighted that using low-fidelity simulation-based training models for high-risk pregnancy management can successfully increase the competencies of obstetrical nurses and midwives. Additionally, the attitude toward simulation-based learning tends to be positive. The results showed that simulation-based training with the integration of problem-based and team-based learning had a positive and significant increase in the knowledge, attitude, and skills related to obstetrical nurses and midwives' competences to manage a comprehensive high-risk pregnant woman and their newborn. Further studies with a larger sample size and a group comparison are recommended to increase the generalization. Moreover, the impact on the real clinical setting should be followed to achieve positive pregnancy outcomes.

CRediT authorship contribution statement

Ratree Sirisomboon: Visualization, Validation, Formal analysis, Data curation, Conceptualization. **Sasitara Nuampa:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Jarunee Leetheeragul:** Writing – review & editing, Validation, Software, Data curation, Conceptualization. **Metpapha Sudphet:** Visualization, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Kanjana Pimol:** Visualization, Validation, Formal analysis, Data curation. **Sudhathai Sirithepmontree:** Writing – review & editing, Visualization, Validation, Software, Methodology, Formal analysis. **Lamngeun Silavong:** Writing – review & editing, Visualization, Validation, Resources, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethics approval and consent to participate

In this study, after coordination with the relevant authorities and obtaining the consent and approval of the participants, the intervention was conducted. There was also confidentiality observed. All participants also provided written informed consent. The authors confirm that all experiments were performed in accordance with relevant guidelines and regulations. Also, they confirm that all methods were carried out in accordance with relevant guidelines and regulations. The authors confirm that the experimental protocols were approved by the Ethics Committee of the Mahidol University Muti-faculty Cooperative IRB Review, Thailand (Ethical Code: MU-MOU CoA No. 128/2023) and National Ethics Committee for Health Research, Vientiane Capital, Lao PDR (Ethical Code: 53/NECHR).

Consent for publication

Not applicable.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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