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EFFECTIVENESS OF OBSTETRIC SIMULATION TRAINING ON MIDWIFERY HIGH-RISK AND EMERGENCY MANAGEMENT COMPETENCIES: A SYSTEMATIC REVIEW

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Abstract

Introduction: Quality midwifery care is crucial for achieving Sustainable Development Goal 3.1, which aims to reduce maternal mortality. Recent findings highlight the importance of both initial and ongoing training for midwives to ensure that every woman and newborn has access to life-saving care. The incorporation of simulation obstetric training is becoming increasingly crucial in midwifery education. Evaluations that focus only on midwifery skills outcomes are limited. This review aims to evaluate the available evidence on simulation-based training in pre-service and in-service midwifery education. **Methods:** A systematic approach was carried out according to (PRISMA) guidelines, to identify original articles in the following databases: Elsevier, Medline, PubMed, Google Scholar. The quality of the included studies was assessed by means of (MMAT) Tool. **Results:** Out of the 546 articles identified, only 13 met the inclusion criteria. The majority of scenarios focused on obstetric complications and emergencies. Results reported an improvement in behavioural skills, confidence, self-efficacy, and knowledge, as well as increased satisfaction following the simulation training. **Conclusion:** The findings strongly support the implementation of simulation in undergraduate midwifery curricula to enhance the quality of midwifery education and demonstrate the importance of investing in simulation to achieve learning outcomes.

Keywords: Simulation, Midwives, Obstetric emergencies, Managing complications, Ongoing training

Introduction

To achieve the Safe Motherhood Initiative, the Sustainable Development Goals (SDG) sets a target for reducing the global maternal mortality ratio to below 70 deaths per 100,000 live births by 2030 under SDG goal 3.1 [1]. The available evidence indicates that midwifery when trained to international midwifery standards has the potential to significantly reduce the incidence of maternal mortality and morbidity, including stillbirths and neonatal deaths, by up to 83% [2]. Therefore, high-quality midwifery education is a crucial foundation to equip midwives with the appropriate competencies to provide safe and evidence-based care [3, 4]. The full range of midwifery interventions, includes preventive and supportive care to keep women well, and identifying and treating complications, ideally before they turn into an emergency [3]. However, despite various global calls and efforts to improve midwifery competencies through education [3], recent studies seem to suggest that midwifery students' and midwives lack competence [5- 7], especially in managing high-risk complications and emergencies [6, 7], and advocate for more training to build up competence and confidence in complex and emergency situations [8]. Enhancing midwives' ability to respond effectively in emergencies can be achieved by regularly updating their skills, ensuring they deliver the best quality patient care [9] Simulation training represents a common approach in the field of engineering midwifery clinical education. Compared to traditional teaching methods, numerous studies have demonstrated that simulation training improves midwifery skills in the management of obstetric complications and emergencies [10- 13]. It enables students to acquire a wide range of skills in real-life situations [14], encourages active learning and teamwork, and considers different learning styles [15]. Evidence revealed that simulation based training ultimately improved knowledge, communication, teamwork and other skills among midwives, nurses and obstetricians [10].

However, implementing new technologies in midwifery education requires assessing their purpose, quality and effectiveness [16]. A number of reviews have been conducted which summarise the

effects of simulation based training on the development of obstetric competence [10, 17]. However, these reviews examined studies with mixed populations, including nursing students with midwifery students or midwives with obstetricians [10]. Other reviews have been focused on some learning outcomes [17]. The challenge is to include studies focusing only on midwifery education and training. To the author's knowledge, there has been no review with this focus. The aim of this systematic review is to evaluate the effectiveness of obstetrics simulation training in midwifery education, and to inform policymakers, managers and educators in Low- and Middle-Income Countries (LMICs) about the importance of investing in simulation to achieve learning outcomes. The results have significant implications for the overall quality of clinical training and midwifery education.

Methods

Search methodology

This systematic review was conducted according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [18]. A systematic approach was used to conduct the searches to ensure the validity and rigour of the findings (**Figure 1**).

The search method employed the PICO (Population, Intervention, Comparator and Outcome) approach to identify relevant studies (**Table I**) [19]. The population of interest was limited to midwifery students or midwives. The study considered simulation training or workshops as interventions, whether compared to other teaching methods or not. The development of obstetrical skills, particularly in managing high-risk and emergency situations, was the outcome. A summary was produced describing the results of each study in relation to educational outcomes. The literature search was conducted using the databases Elsevier, Medline, PubMed, Google Scholar, covering publications from the past ten years, between 2015 and 2025. The search terms were "obstetrics emergencies", "obstetrics training", "midwifery education", "midwives", "students" "innovative pedagogy", "Simulation", "simulation training", "technologies".

Table I. Summary of the search methodology

Variables	Components
Population	midwifery students or midwives
Intervention	Simulation training Simulation workshops
Comparator	N/A*
Outcome	Development of midwifery skills Development of obstetrical skills in managing high-risk and emergency situations.

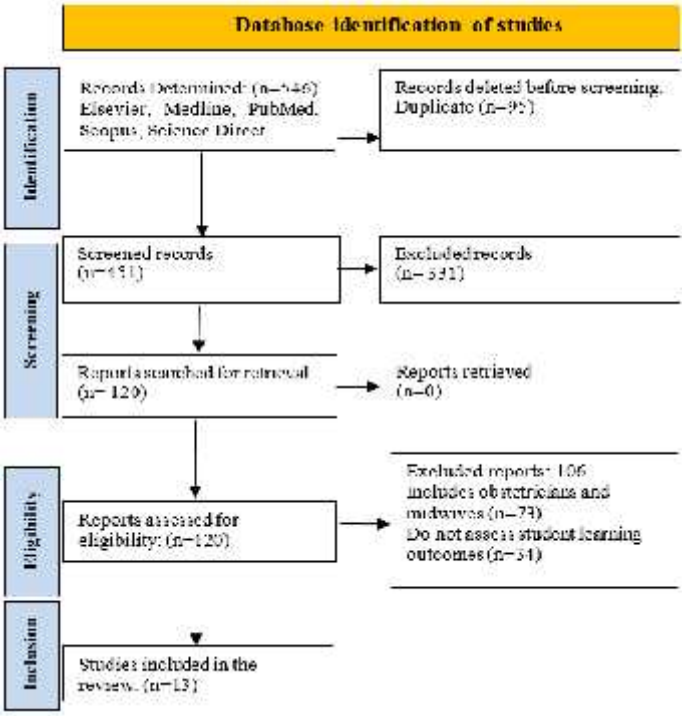

Figure 1. Flowchart (PRISMA, 2020) showing the study process for this review

Inclusion and exclusion criteria

Original studies that report the use of technology to educate midwifery students and registered midwives were included. This study exclusively considered peer-reviewed research assessing the impact of educational interventions, including only papers published in English within the past ten years from 2015 to 2025. The study's inclusion criteria were: 1) Studies with a sample of at least 70% midwives and midwifery students, 2) full text papers, and 3) a focus on learning outcomes rather than assessing materials. This study excludes conference abstracts, research protocols, knowledge syntheses and opinion pieces as they typically lack detail and empirical data. Data from 13 studies deemed eligible for inclusion were extracted and abstracted into a template, including authors' names, year and country of publication, titles, objectives, sample sizes, methods and tools, outcomes and conclusions (**Table II**).

Critical appraisal

Three reviewers (MM, MA and RJI) evaluated the methodology of all included studies utilising the Mixed Methods Appraisal Tool (MMAT) [20]. Five types of research designs were assessed: (1) randomized controlled trials, (2) non-randomized research, (3) quantitative descriptive research, (4) qualitative research and (5) mixed methods. An overall quality score was not assigned, as recommended by Hong et al. [20].

Results

Methodology for selecting studies

Following a comprehensive literature search, 546 articles were identified for further analysis. Of these, 426 were excluded following deduplication and screening methods. A total of 120 reports were subjected to a comprehensive and thorough review of their full texts in accordance with the previously established and clearly defined inclusion and exclusion criteria. After a comprehensive review, a total of 13 studies were selected for inclusion (**Figure.1**). The results have been categorised in terms of learning outcomes.

Characteristics of studies

Thirteen papers met the inclusion criteria (Table II). This review highlights a lack of studies that focus exclusively on midwifery students. The loss of data was also caused by methodological quality. The research involved 811 midwifery students and 202 licensed midwives, with only one study including 13 obstetricians. All papers focused solely on midwifery. Concerning the distribution of studies, two studies were from South Africa [15,21], two from Australia [11, 22], one from Ethiopia [23], one from Sweden[24], Two from Iran [12, 13], two from Turkey [25, 26], one from Belgium [27], one from United States [28], and one from Hong Kong [29]. In terms of content, all studies were designed to improve midwifery students' competence in recognising and managing obstetric complications and emergencies. A significant number of studies did not include a discussion of the theoretical underpinnings of the educational interventions and this continues to be a persistent problem in educational research in midwifery education. Furthermore, the interventions were evaluated using pre- and post-test questionnaires, and only two studies [12, 13] reported the use of an objective tool to assess learning outcomes. The same finding was reported in a systematic review that recommended the use of validated observational assessment tools in emergency training programmes to ensure that simulations achieve their intended educational outcomes [10]. However, the review included a wide range of designs, and educational interventions, which enabled a systematic evaluation of their effectiveness in terms of learning outcomes.

The included studies comprised 2 mixed-method studies, 2 qualitative studies, 6 quantitative non-randomised studies, and 3 randomised studies. All reviewed studies were evaluated using the Mixed Methods Appraisal Tool (MMAT). Six studies achieved 100% alignment with MMAT criteria, five studies aligned to 80% of criteria, one study aligned to 60% and one study to 40%.

Table II. Results and characteristics of the reviewed studies (n=13)

Author	Country	Objectives	Sample size	Data collection	Data analysis	Outcomes
Amod & Brysiewicz, 2017 [15]	South Africa	Development, implementation and evaluation of a simulation learning package (SLP) on postpartum haemorrhage	Midwifery students (n=43) Midwives (n=10)	Questionnaire Focus group	SPSS Version 23.0 and content analysis	High-fidelity simulation enhances self-confidence, knowledge, clinical skills, critical thinking, and satisfaction
Amod & Brysiewicz, 2019 [21]	South Africa	Explore how HFHPS promotes experiential learning about midwifery emergencies like PPH.	Midwifery students (n= 20)	Focus group	content analysis	High-fidelity simulations provide student midwives with a unique opportunity to manage complex, real-life emergencies. They enhance skills development.
Stoodley C, McKellar L, Mary Steen, & Fleet J, 2020 [11]	South Australia	Assess the impact on knowledge, confidence and skills.	Step 1: Midwifery students (n = 60) Step 2: Midwifery Students (n = 46)	Questionnaire	Descriptive statistics Linear regression model Thematic analysis.	The students' knowledge, confidence, and skills showed a significant increase after participating in simulation activities (p0.001).
Carolan-Olah M, Kruger G, Brown V, Lawton F, & Mazzarino M, 2016 [22]	Australia	Develop and evaluate a neonatal resuscitation simulation exercise	Midwifery students (n= 36)	Two questionnaires	Descriptive statistics	Simulation improves Students' neonatal resuscitation confidence, knowledge and skills.
Gudayu T W, Badi M B, & Asaye M M, 2015 [23]	Ethiopia	Evaluate the impact of simulation-based training on participants' confidence and satisfaction levels	Midwifery students (n=144)	Questionnaire	Descriptive statistics Logistic regression analysis (Binary and multivariable)	Significant differences, p value < 0.001
Lendahls and Oscarsson, 2017 [24]	Sweden	Explore the experiences of midwifery students with simulation training.	Midwifery students (n = 61)	Semi-structured interview guide	Content analysis	The development of midwifery skills can be supported by simulation and skills training.
Tabatabaeian M, Kordi M, Dadgar S, Esmaeily H, & Khadivzadeh T, 2018 [12]	Iran	Compare the effects of simulation, blended and didactic education.	90 midwives	Objective structured clinical test	Kruskal–Wallis tests one‐way ANOVA, T‐test, Wilcoxon and.	Midwives' mean score performance was significantly increased, P < 0.001. Average performance scores were significantly higher in simulation groups P < 0.001.
Kordi M, Erfanian F, Fakari F R, Dastfan F, & Nejad K S, 2017 [13]	Iran	Compare the effectiveness of simulated method and the oral method, on the skills of midwives.	51 midwives	Questionnaire	Wilcoxon U‐test Mann–Whitney	Skills were significantly greater in the simulation group P = 0.040.
Demirel G, Evcili F, Kaya N, & Doganer A, 2019 [25]	Turkey	Investigate how a simulation on episiotomy repair affected anxiety and self-efficacy in midwifery trainees.	Midwifery students n=73	Questionnaire	McNemar's and Wilcoxon test	Simulation training enhance self-efficacy scores, P<0.000 and decrease the anxiety levels, P<0.000
Vermeulen J, Buyl R, D'haenens F, Swinnen E, Stas L, Gucciardo L, & Fobelets M, 2021 [27]	Belgium	Validating a satisfaction tool for use with midwifery students and assess their satisfaction	Midwifery students n=251	Questionnaire	Factor analysis Cronbach's alpha Thematic content analysis.	Students reported high satisfaction with being trained in perinatal simulation.
Grabowski A, Chuisano S A, Strock K, Zielinski R, Anderson O S, & Sadovnikova A, 2021 [28]	United States	Evaluates the impact of breastfeeding simulation on the self-efficacy	Midwifery student n=9	Questionnaire Focus group	Descriptive statistics mixed effects repeated measures ANOVA	Simulation increases students' self-efficacy, P < .0001
Yilar Erkek Z, & Öztürk Altinayak S, 2021[26]	Turkey	Evaluate the effect of simulation training on episiotomy skills and levels of anxiety.	Midwifery students n=68	Questionnaires	Percentages and means, Chi-square test Pearson's correlation	Simulation improves midwifery students' episiotomy skills, p < .05
Lee MMH, Chan C N, Lau BYT & Ma TWL, 2017 [29]	Hong Kong	Test the hypothesis that skills decline over time following simulation training.	Obstetricians n= 13 Midwives n= 51	Pre and post test	ANOVA T-tests	Simulation training improves shoulder dystocia management in the short and long term. However, knowledge decreases over time, p< 0.001.

Learning outcomes of obstetric simulation training midwifery education

The use of simulation as a pedagogical instrument in midwifery training has demonstrated its effectiveness in enhancing the performance of midwifery students and midwives in the management of high-risk complications and emergencies.

Effects on behaviour skills

Seven studies assessed the development of behavioural skills in relation to the management of high-risk complications and emergencies. Amod and Brysiewicz [15, 21] reported that high-fidelity simulation is an innovative and interactive strategy of learning that increases clinical skills and critical thinking abilities in managing postpartum haemorrhage. The findings of the same studies indicated that high-fidelity simulation can be effectively employed in complex case scenarios of obstetric emergencies. A comparison of simulation training for the management of pre-eclampsia and eclampsia with blended and lecture-based learning was conducted by Tabatabaeian et al. [12]: the simulation group demonstrated superior performance compared to the blended learning and lecture-based groups. The same results were presented by Kordi et al. [13], demonstration of a significant difference in the management of shoulder dystocia between the simulation-trained group and the traditional-trained group. The authors therefore recommended the use of simulation to learn this skill. Additional evidence was provided by Stoodly et al. [11] who reported significant improvements in students' skills in caring for preterm neonates through simulation. The results of the research demonstrated that simulation represents an effective learning strategy within this field of practice. This is evidenced by the students' skills being found to have increased both post-simulation and post-placement. Furthermore, Yilar Erkek et al. [26] conducted a research study to evaluate the effectiveness of simulation as a teaching tool and concluded that the experimental group scored significantly higher than the control group, confirming the effectiveness of this approach. Nevertheless, evidence suggests that knowledge and skills can decline over time, highlighting the importance of ongoing training to sustain clinical competence [29].

Effects on confidence and self-efficacy

Four studies have shown a significant increase in confidence after simulation training, particularly for managing post-partum haemorrhage [15], care of preterm neonates [11], neonatal resuscitation [22], and both normal and complicated births [24]. Additionally, the literature highlighted that students reported a feeling of preparation and confidence before their clinical practice after completion of their simulated training [24]. Consequently, all the aforementioned studies have advised its incorporation into the curriculum. Simulation training has also been studied for its effects on self-efficacy among midwifery students. A quasi-experimental study conducted in Turkey revealed that students who underwent episiotomy repair training demonstrated increased levels of self-efficacy following the simulation [25]. The same findings were reported in a classroom workshop, where students reported higher perceived self-efficacy, and expressed the need for more simulation training [28]. A further study in Ethiopia revealed that students who rated their teacher's assistance as 'good' demonstrated a statistically significant increase in self-efficacy during skill practice [23]. This emphasises the importance of educator support.

Effects on knowledge acquisition

Four studies, tested clinical knowledge improvements related to simulation training [11,15, 22,29]. The assessment post intervention was conducted using a pre/post questionnaire. The most commonly assessed emergency scenarios included postpartum haemorrhage, pre-eclampsia, eclampsia, shoulder dystocia management, neonatal resuscitation, and care of the preterm newborn. Therefore, Three studies have demonstrated that simulation training has led to improvements in clinical knowledge [11,15,22]. In contrast, one study demonstrated a decline in knowledge over time after simulation training, and recommended ongoing training for all obstetric team members at a minimum interval of 12 months [29].

Effects on students' Satisfaction

Three studies demonstrated that simulation enhances midwifery student's satisfaction [15,23,27]. However, students reported that simulation-based learning was helpful and appropriate during postpartum haemorrhage training because it improved their perceptions of clinical competence [15]. Similarly, the materials used in the simulation sessions, and the educators' support during skill practice were reported to increase student's satisfaction [23]. Participants in a study conducted to validate a satisfaction scale for simulation training, were very satisfied with simulation training in perinatal suturing and felt that it added value to their training [27].

Discussion

Current evidence shows that little teaching can be done in obstetric emergencies due to the complexity of these situations [15]. This systematic review assessed the effectiveness of obstetric simulation in improving midwifery skills, particularly in managing high-risk and emergency situations. Therefore, all included studies indicated that simulation was an effective teaching tool for improving clinical skills in the management of high-risk complications and emergencies, and recommended its implementation in midwifery curricula [11-13,15,21,26,29]. Key aspects contributing to student learning included practising skills, and the role that the student assumed on in the simulation activity, which is critical in an emergency situation [11]. Another crucial aspect of the simulation method is the learning environment, as simulation environments are typically designed to be less stressful, allowing for more focused and effective learning [12]. We can therefore conclude that simulation training can help to overcome some of the challenges of the clinical setting by providing realistic emergency scenarios in a controlled environment. Simulation has been compared with traditional methods and the results indicated that simulation is more effective in improving skills and behaviours and provided a more effective and satisfying learning experience [12, 13]. By providing different learning scenarios, this method can be adapted to different learning levels [12]. It also provides practical, hands-on experience and promotes active learning and skill acquisition compared to traditional methods, especially in emergency and crisis management.

Studies investigating the impact of simulation on knowledge acquisition found a significant improvement [10,11,15,22]. An umbrella review found similar results, providing evidence that integrating high-fidelity simulation into healthcare programmes improves students' skills [30]. However, there is evidence of a decline in knowledge at six and twelve months, suggesting the need for ongoing training every six months [29]. Therefore, engineering midwifery curricula should consider aligning simulation activities with placement experiences. When students complement the simulation activity with the experience of a clinical placement, it provides an opportunity to consolidate their skills [11]. In terms of confidence, four studies [11,15, 22, 24] reported a high level of confidence among midwifery students after simulation training. Reasons cited included the opportunity for repetitive practice in a safe and secure environment [24], and the ability to make mistakes without compromising patient safety [24]. Similar findings have been reported in an integrative review, indicating that simulation should be considered as part of critical care training [17].

Self-efficacy in clinical performance is essential for the effective application of competencies. This study showed that training in the laboratory environment through simulation is necessary to improve students' self-efficacy [23,25,28]. These results are consistent with the results of a correlation study by Mohamadrizi et al. [31] indicating that a student's clinical performance is significantly predicted by their self-efficacy levels. High levels of efficacy minimise the negative effects of stress and anxiety [25], and help apply skills to patient care [28]. Ultimately, the quality of care provided by midwifery students is influenced by both their self-efficacy and their competency levels.

The findings of this systematic review demonstrate that simulation training is an extremely effective method of enhancing students' practical abilities. Moreover, students expressed high levels of satisfaction with the skills they acquired [15] and the support they received from their educators [23]. In addition, students perceived simulation training as adding value to their education and training by allowing them to learn from mistakes [27]. High levels of satisfaction are generally linked to greater engagement and a stronger motivation to learn [32].

Based on the findings of this study, it can be concluded that the use of simulation as a teaching strategy has the potential to improve midwifery student' and midwives' ability to recognise and manage risk and emergency situations. Key findings indicate improvements in behavioural skill development, student confidence, self-efficacy, knowledge and satisfaction. Therefore, obstetrics high-risk and emergency is a challenging and demanding environment that requires highly skilled professionals. Insights derived from the literature indicated a limited opportunities for midwifery students to practice high-risk/emergency skills in clinical wards [6]. In order to compensate for a lack of experience, it is essential to identify additional training methods [33]. This review provides strong support for the implementation of simulation training in pre-service and in-service midwifery education. This is in line with the WHO's [3] recommendations for strategic investment in midwifery education to improve maternal and child health outcomes. Results of this study could undoubtedly encourage local, regional and international decision-makers to invest more in the training of midwives, who are key players in any strategy to improve maternal and child health indicators. Nevertheless, this study is limited by the scarcity of research solely dedicated to preservice and in-service midwifery education. Moreover, the study highlights a lack of convincing results on the assessment of cost-effectiveness, which is a very important determinant in the implementation of any new strategy. Research into the standardization of simulation education programmes is also strongly recommended, to enable the nursing and midwifery

education community to better understand and optimize simulation education.

Conclusion

This systematic review provides a clear insight of simulation-based learning and its effectiveness on midwifery education. It is clear that simulation is a beneficial teaching tool in preservice midwifery education, particularly for high-risk procedures, complications and emergency management skills. This is due to the challenges of teaching these skills in a real ward, where concerns about the safety of women and their unborn children arise. The evidence presented in this review can be used as an input to improve the quality of midwifery education, particularly for countries aiming to achieve the Millennium Development Goals of reducing maternal and neonatal deaths.

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