



THE EFFECT OF CASE-BASED MATERNAL AND NEONATAL EMERGENCY SIMULATION ON PHARMACOLOGY COMPETENCE OF MIDWIFERY STUDENTS

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ABSTRACT

Maternal and neonatal emergencies such as postpartum hemorrhage, severe preeclampsia/eclampsia, and neonatal asphyxia require prompt and accurate pharmacological management. However, midwifery students' pharmacology competence in managing emergencies is often limited to theoretical classroom learning, so a more applicable learning method such as case-based simulation is needed. This study aimed to analyze the effect of case-based maternal and neonatal emergency simulation on the pharmacology competence of midwifery students at STIKes Yahya Bima. This study used a quantitative quasi-experimental design with a one-group pretest-posttest approach. The sample consisted of 42 third-year Diploma III Midwifery students selected using a total sampling technique. Data were collected using a 30-item maternal and neonatal emergency pharmacology competence test, which had been tested for validity using the Pearson correlation test and was declared reliable with a Cronbach's alpha value of 0.842. Data were analyzed using the Shapiro-Wilk normality test and the Paired t-test. The results showed that the mean pharmacology competence score before the simulation was 58.4 (SD=9.2), increasing to 82.7 (SD=7.5) after the simulation, with a mean difference of 24.3 points ($p=0.000$). The proportion of students in the good competence category increased from 9.5% to 57.1% after the intervention. Further analysis showed that the increase in scores was significantly higher among students with a grade point average (GPA) ≥ 3.00 ($p=0.031$), while age and prior clinical practice experience showed no significant difference. Conclusion: Case-based maternal and neonatal emergency simulation has a significant effect on improving the pharmacology competence of midwifery students.

Keywords: case-based simulation; maternal neonatal emergency; midwifery students; pharmacology competence

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INTRODUCTION

Maternal and neonatal emergencies are life-threatening conditions for mothers and newborns that demand a rapid, accurate, and evidence-based clinical response. Postpartum hemorrhage, severe preeclampsia/eclampsia, and neonatal asphyxia remain major contributors to maternal and infant mortality rates in Indonesia (Ministry of Health of the Republic of Indonesia, 2023). The management of these conditions is highly dependent on the accuracy of pharmacological therapy, such as the administration of oxytocin and tranexamic acid for postpartum hemorrhage, magnesium sulfate for severe preeclampsia, and epinephrine and resuscitation for neonatal asphyxia (Ministry of Health of the Republic of Indonesia, 2022; WHO, 2023).

Emergency pharmacology competence is one of the core competencies that midwifery students must master as future frontline health workers. However, pharmacology learning has so far been dominated by lecture-based and memorization-oriented methods in the classroom, so students often find it difficult to apply pharmacological knowledge in dynamic and high-pressure real clinical situations (Nursalam, 2021; Billings & Halstead, 2022). This gap between theoretical knowledge and applied ability has the potential to reduce students' readiness to face emergency cases in clinical practice settings (Jeffries, 2021).

Case-based simulation is an active learning method that allows students to practice clinical decision-making, including pharmacological decisions, in scenarios that resemble real conditions without risk to patients (Jeffries, 2021; INACSL Standards Committee, 2021). Simulation is no longer considered a novelty in health professions education but has become an established pedagogical strategy, provided that fidelity and scenario design are carefully aligned with intended learning outcomes (Aebbersold, 2021; Alinier & Oriot, 2022). This approach is in line with experiential learning theory, which emphasizes that the most effective learning occurs through concrete experience, reflection, conceptualization, and active experimentation (Kolb, 2020). A concept analysis further clarifies that simulation as a learning strategy integrates cognitive, psychomotor, and affective domains simultaneously, distinguishing it from conventional classroom instruction (Bland et al., 2021). Several studies and meta-analyses have shown that case-based clinical simulation can improve knowledge, psychomotor skills, confidence, and the readiness of health science students to manage emergencies compared with conventional learning methods (Cant & Cooper, 2022; Chernikova et al., 2022; Tosterud et al., 2021; Motola et al., 2021).

In Indonesia, the application of case-based simulation for maternal and neonatal emergencies in midwifery education remains relatively limited, and most previous studies have focused more on general psychomotor skills without specifically measuring pharmacology competence (Wulandari & Sari, 2022; Rahmawati, 2023). Related local studies have reported that simulation-based methods improve midwifery students' confidence (Dewi & Handayani, 2022) and clinical practice readiness (Fauziah & Kurniawati, 2023), while emergency skills training among practicing midwives has also been shown to strengthen maternal emergency management skills (Lestari & Prasetya, 2022) and newborn resuscitation ability (Purwanti & Anggraini, 2023). This indicates a research gap that needs to be further explored, particularly regarding pharmacology competence specifically, in midwifery education institutions in regions where simulation facilities are still developing.

STIKes Yahya Bima, as one of the midwifery education institutions in Bima City, continues to strive to improve the quality of clinical learning through the development of simulation-based learning methods. Therefore, this study is important to analyze the effect of case-based maternal and neonatal emergency simulation on the pharmacology competence of midwifery students. The purpose of this study was to analyze the effect of case-based maternal and neonatal emergency simulation on the pharmacology competence of midwifery students at STIKes Yahya Bima.

METHOD

This study used a quantitative design with a quasi-experimental one-group pretest-posttest approach. The study was conducted at the Diploma III Midwifery Study Program of STIKes Yahya Bima from April to May 2026. The study population consisted of all third-year (fifth-semester) midwifery students who had completed the Maternal Neonatal Emergency Care course, totaling 42 students. The sample was determined using a total sampling technique, so that all members of the population who met the inclusion and exclusion criteria were included as respondents. The independent variable in this study was case-based maternal and neonatal emergency simulation, while the dependent variable was midwifery students' pharmacology competence. The simulation intervention was conducted in four sessions over four consecutive weeks, covering case scenarios of postpartum hemorrhage, severe preeclampsia/eclampsia, neonatal asphyxia, and obstetric shock, using resuscitation manikins and a simulated drug tray, with structured pre-briefing, simulation implementation, and debriefing stages in each session (Jeffries, 2021; INACSL Standards Committee, 2021).

The research instrument was a maternal and neonatal emergency pharmacology competence test consisting of 30 multiple-choice items covering the accuracy of drug type, dosage, route of administration, and awareness of side effects. The instrument was tested for validity using the Pearson correlation test, with all items declared valid (r calculated $>$ r table), and tested for

reliability with a Cronbach's alpha value of 0.842, indicating that the instrument was reliable. Competence scores were categorized as poor (score <60), fair (score 60–79), and good (score ≥80). Data were collected by administering a pretest before the simulation was conducted and a posttest after all simulation sessions were completed. Data analysis included univariate analysis to describe respondent characteristics and the distribution of competence categories, as well as bivariate analysis using the Shapiro-Wilk normality test, which showed that the data were normally distributed ($p>0.05$), followed by the Paired t-test to determine the difference in competence scores before and after the intervention, and the Independent t-test to analyze differences in score improvement based on respondent characteristics, with a significance level of 0.05.

RESULT

Table 1.

Distribution of Respondent Characteristics Based on Age, Grade Point Average (GPA), and Prior Emergency Clinical Practice Experience (n=42)

Characteristics	Category	f	%
Age	19–21 years	27	64.3
	22–24 years	15	35.7
GPA	<3.00	12	28.6
	≥3.00	30	71.4
Emergency practice experience	None	24	57.1
	Had experience	18	42.9

The majority of respondents were aged 19–21 years (64.3%) and had a GPA ≥3.00 (71.4%). A total of 57.1% of respondents had never had direct practical experience in managing maternal and neonatal emergency cases prior to the study.

Table 2.

Distribution of Pharmacology Competence Categories Before and After Case-Based Emergency Simulation (n=42)

Competence Category	Pretest (f)	%	Posttest (f)	%
Poor (<60)	26	61.9	3	7.1
Fair (60–79)	12	28.6	15	35.7
Good (≥80)	4	9.5	24	57.1

There was an increase in the proportion of students in the good competence category, from 9.5% at pretest to 57.1% at posttest, accompanied by a decrease in the proportion in the poor category from 61.9% to 7.1% after the implementation of the case-based emergency simulation.

Table 3.

Paired t-test Results for Pharmacology Competence Scores Before and After Simulation (n=42)

Variable	Mean	SD	Mean Difference	t	p-value
Pretest score	58.4	9.2			
Posttest score	82.7	7.5	24.3	18.452	0.000*

Note: *significant at $p<0.05$; 95% CI of mean difference = 21.6–27.0

The Paired t-test results showed a significant difference between pharmacology competence scores before and after the case-based emergency simulation ($p=0.000$), with a mean score increase of 24.3 points.

Table 4.

Differences in Pharmacology Competence Score Improvement Based on Respondent Characteristics (Independent t-test) (n=42)

Characteristics	Category	Mean Improvement	t	p-value
Age	19–21 years	24.9	1.102	0.277
	22–24 years	23.1		
GPA	<3.00	20.2	2.214	0.031*
	≥3.00	25.9		
Practice experience	None	25.1	0.845	0.403
	Had experience	23.2		

Note: *significant at $p<0.05$

Further analysis showed that the increase in pharmacology competence scores was significantly higher among students with a GPA ≥ 3.00 compared with those with a GPA < 3.00 ($p=0.031$). Meanwhile, age and prior emergency clinical practice experience showed no significant difference in score improvement ($p>0.05$).

DISCUSSION

The univariate analysis results showed that the majority of respondents were in the young adult age group with a relatively good GPA, although more than half of the respondents had no direct practical experience in managing maternal and neonatal emergencies. This condition illustrates that students' clinical exposure to emergency cases remains limited, making simulation-based learning an important strategy to bridge the gap between theory and practice before students are confronted with real situations in clinical settings (Billings & Halstead, 2022; Jeffries, 2021).

The increase in mean pharmacology competence scores from 58.4 to 82.7 after the simulation indicates that the case-based simulation method is effective in improving students' ability to apply pharmacological knowledge in clinical situations resembling real conditions. This finding is consistent with experiential learning theory, which states that learning through direct experience, accompanied by reflection and debriefing, can strengthen conceptual understanding as well as clinical decision-making skills (Kolb, 2020; INACSL Standards Committee, 2021). Reflective practice embedded within the debriefing process allows students to reconstruct their clinical reasoning and correct misconceptions regarding drug selection and dosage calculation immediately after the simulated encounter, rather than relying solely on delayed classroom feedback (Husebø et al., 2021). Simulation also provides an opportunity for students to repeatedly practice determining the type of drug, dosage, and route of administration in a safe environment, thereby strengthening the retention of pharmacological knowledge and, more broadly, students' self-efficacy in performing emergency procedures (Cant & Cooper, 2022; Franklin & Lee, 2022).

The decrease in the proportion of students in the poor competence category from 61.9% to 7.1% also indicates that case-based simulation not only increased the mean score but also promoted more equal competence attainment among students with varying baseline abilities. The structured debriefing stage in each simulation session allowed students to receive direct feedback on errors in pharmacological decision-making, which subsequently improved their understanding in subsequent sessions (Tosterud et al., 2021). This pattern is consistent with findings on scenario-based clinical learning among midwifery students, in which repeated exposure to structured case scenarios was associated with greater practice readiness regardless of students' initial competence level (Fauziah & Kurniawati, 2023).

Further analysis showed that students with a GPA ≥ 3.00 experienced a significantly higher increase in competence scores compared with students with a GPA < 3.00 . This is in line with the view that basic academic ability influences the speed and depth of students' understanding of new material delivered through simulation, including understanding of pharmacological principles, which are inherently complex (Notoatmodjo, 2020; Rahmawati, 2023), and is consistent with a reported association between academic achievement index and clinical competence attainment among health science students (Indriani, 2023). Conversely, age and prior clinical practice experience did not show a significant difference in improvement, indicating that the benefits of case-based simulation are evenly distributed and can be felt by both students with and without prior practice experience, because simulation provides more structured and repetitive case exposure compared with incidental experience in clinical settings (Wulandari & Sari, 2022). This finding also aligns with reports that simulation-based training improves midwifery students' confidence in managing emergencies independent of their prior clinical exposure (Dewi & Handayani, 2022).

These findings reinforce the evidence that the case-based simulation method can serve as an effective active learning strategy to improve maternal and neonatal emergency pharmacology competence in midwifery education, particularly in institutions with limited direct clinical practice placements such as STIKes Yahya Bima. Nevertheless, the success of simulation still needs to be supported by facilitator quality, the completeness of teaching aids, and the design of case scenarios relevant to real clinical conditions (Jeffries, 2021).

CONCLUSION

Case-based maternal and neonatal emergency simulation has a significant effect on improving the pharmacology competence of midwifery students at STIKes Yahya Bima, as shown by a mean competence score increase of 24.3 points ($p=0.000$) and an increase in the proportion of students in the good competence category from 9.5% to 57.1%. Grade point average contributed to the magnitude of the increase in competence scores, while age and prior clinical practice experience did not have a significant effect.

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