



THE EFFECTIVENESS OF SCENARIO-BASED SIMULATION TRAINING FOR PERIANESTHETIC EMERGENCIES ON ANESTHESIA NURSES' PREPAREDNESS AND ACCURACY OF CLINICAL INTERVENTIONS

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ABSTRACT

Although anesthesia nurses play a crucial role in managing perianesthetic emergencies, various reports continue to indicate delays and inaccuracies in clinical interventions due to limited clinical experience and suboptimal training methods. This study aimed to determine the effectiveness of perianesthetic emergency scenario-based simulation training on the preparedness and accuracy of anesthesia nurses' clinical interventions. This study employed a quasi-experimental design with a one-group pretest–posttest approach and was conducted at Siti Rahmah Islamic Hospital from January to June 2026. The study population consisted of all anesthesia nurses working in the operating room, and a total sampling technique was used to recruit 12 respondents. Preparedness was assessed using a questionnaire, while the accuracy of anesthesia nurses' interventions was evaluated using an observation checklist. The questionnaire was found to be valid and reliable, with a Cronbach's alpha coefficient of 0.841. Data were analyzed using univariate and bivariate statistical methods. The results showed that most respondents were aged 25–35 years (66.7%), male (58.3%), held a Diploma IV degree in Nurse Anesthesiology (66.7%), and had 0–5 years of work experience (75.0%). The mean preparedness score increased from 38.91 ± 8.20 during the pre-test to 44.25 ± 3.69 during the post-test. Similarly, the mean score for intervention accuracy increased from 12.00 ± 1.47 at pre-test to 12.75 ± 1.05 after receiving perianesthetic emergency scenario-based simulation training. Statistical analysis revealed that scenario-based simulation training had a significant effect on improving anesthesia nurses' preparedness ($p = 0.015$) and the accuracy of their clinical interventions ($p = 0.032$).

Keywords: accuracy of clinical interventions; anesthesia nurse; preparedness; scenario-based simulation

INTRODUCTION

Patient safety is one of the most important indicators of healthcare quality, including anesthesia services and the perianesthetic period, which are associated with a high risk of clinical complications and emergencies (Choi et al., 2023). The perianesthetic phase encompasses the periods before, during, and after anesthesia administration, during which patients require close monitoring because physiological changes may occur rapidly and unpredictably (Shin et al., 2020). Airway compromise, hemodynamic instability, adverse anesthetic drug reactions, and respiratory complications are among the conditions that can progress into life-threatening emergencies if not recognized and managed promptly and appropriately (Baishya et al., 2023).

Anesthesia nurses play a critical role in ensuring patient safety throughout the perianesthetic process by monitoring patient conditions, identifying early signs of clinical deterioration, facilitating team communication, and implementing initial interventions within their professional scope of practice (Lien, 2011). Preparedness and accuracy of clinical interventions are essential factors influencing the successful management of emergencies in both operating rooms and post-anesthesia care units (Anesthesiologists, 2022). Nevertheless, anesthesia nurses' ability to respond effectively to emergency situations may be influenced by clinical experience, exposure to critical cases, training opportunities, and decision-making skills under high-pressure conditions (Gutiérrez-Perdomo et al., 2024).

One educational approach that has gained increasing attention in healthcare education and professional development is simulation-based training (Cant & Cooper, 2020). This method has been shown to enhance clinical competence, communication skills, teamwork, and decision-making abilities without exposing patients to direct risks (Motola et al., 2020). Scenario-based simulation provides participants with opportunities to encounter clinical situations that closely resemble real-life practice, enabling them to develop systematic skills in problem identification, clinical response, and procedural performance (Lin et al., 2025).

Several studies have demonstrated that simulation training is effective in improving healthcare professionals' competencies, particularly in the management of critical and emergency conditions (Lin et al., 2025; Motola et al., 2020). However, research examining the effectiveness of perianesthetic emergency simulation training specifically in relation to anesthesia nurses' preparedness and accuracy of clinical interventions remains limited. Most previous studies have primarily focused on improving knowledge, self-confidence, or general clinical skills among healthcare professionals (Baishya et al., 2023; Gutiérrez-Perdomo et al., 2024). This gap highlights the need for further research evaluating the effectiveness of scenario-based simulation training within the specific context of perianesthetic practice.

This study is important because it is expected to provide empirical evidence regarding the impact of scenario-based simulation training on the preparedness and accuracy of anesthesia nurses' clinical interventions when managing perianesthetic emergencies. This study aims to determine the effectiveness of scenario-based simulation training for perianesthetic emergencies on anesthesia nurses' preparedness and the accuracy of their clinical interventions. The findings may contribute to the development of more structured, practical, and clinically relevant training methods for anesthesia practice, while also supporting ongoing efforts to improve patient safety in hospital settings.

METHOD

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest format. The study aimed to analyze the effectiveness of perianesthetic emergency scenario-based simulation training on the preparedness and accuracy of anesthesia nurses' clinical interventions. The research was conducted from January to June 2026. The sample consisted of a single group of anesthesia nurses who received scenario-based simulation training for perianesthetic emergencies. A total sampling technique was applied, resulting in the inclusion of 12 anesthesia nurses working in the operating room of Siti Rahmah Islamic Hospital. Data were collected using an anesthesia nurse preparedness questionnaire and an observational checklist to assess the accuracy of clinical interventions performed by anesthesia nurses. The instruments had undergone validity and reliability testing prior to data collection, yielding a Cronbach's alpha coefficient of 0.841, indicating that the questionnaire was both valid and reliable for use in this study.

During the pre-intervention phase, respondents were recruited, informed consent was obtained, and baseline measurements (pretest) were conducted to assess preparedness and the accuracy of clinical interventions among anesthesia nurses. The intervention consisted of perianesthetic emergency scenario-based simulation training delivered by Ns. Aric Frendy Adriyan, M.Kep and Ns. Dewi Kartika Sari, M.Kep, both of whom are certified instructors. The training was conducted over one day with a total effective duration of six hours. Participants received a training module, and the program was organized into five learning sessions, followed by direct mentoring and guidance from the instructors. The post-intervention phase involved reassessment (posttest) of anesthesia nurses' preparedness and the accuracy of their clinical interventions.

After data collection, all data were processed and analyzed using SPSS version 22. Univariate analysis was performed to describe respondents' characteristics and to calculate the mean

preparedness and intervention accuracy scores before and after the scenario-based simulation training. Subsequently, bivariate analysis was conducted to determine the effect of perianesthetic emergency scenario-based simulation training on anesthesia nurses' preparedness and the accuracy of their clinical interventions.

This study received ethical approval from the Research Ethics Committee of the Faculty of Medicine, Baiturrahmah University, under approval number 073/ETIK-FKUNBRAH/03/06/2026. The study was conducted in accordance with established ethical principles for research involving human participants, including the protection of data confidentiality, respect for participants' rights, voluntary participation, and the provision of informed consent prior to data collection.

RESULT

The results of this study are presented in the following table.

Table 1.

Frequency Distribution of Respondents' Characteristics Based on Age, Gender, Educational Level, and Work Experience

Variable	n = 12	
	f	%
Age		
25 - 35 Year	8	66.7
>35 - 45 Year	2	16.7
> 45 - 55 Year	2	16.7
Gender		
Male	7	58.3
Female	5	41.7
Educational Level		
Diploma III in Nursing	1	8.3
Diploma IV in Nurse Anesthesiology	8	66.7
Ners	2	16.7
Master of Nursing	1	8.3
Work Experience		
0 – 5 Years	9	75.0
>5 Years	3	25.0

Based on table 1, the respondents were predominantly aged 25–35 years (66.7%), male (58.3%), held a Diploma IV in Nurse Anesthesiology (66.7%), and had 0–5 years of professional work experience (75.0%).

Table 2.

Mean Scores of Anesthesia Nurses' Preparedness and Accuracy of Clinical Interventions Before and After Perianesthetic Emergency Scenario-Based Simulation Training

Variabel	n=12	
	Mean ± SD	Min- Max
Anesthesia Nurses' Preparedness		
Pre-test	38,91 ± 8,20	19 - 48
Post-test	44,25 ± 3,69	37 – 48
Accuracy of Anesthesia Nurses' Clinical Interventions		
Pre-test	12,00 ± 1,47	10 - 14
Post-test	12,75 ± 1,05	10 - 14

Based on table 2, the mean preparedness score of anesthesia nurses increased from 38.91 ± 8.20 at pre-test to 44.25 ± 3.69 at post-test. The preparedness scores ranged from 19 to 48 before the intervention and from 37 to 48 after the intervention. Meanwhile, the mean score for the accuracy of anesthesia nurses' clinical interventions also increased from 12.00 ± 1.47 at pre-test to 12.75 ± 1.05 at post-test, with score ranges of 10–14 at both pre-test and post-test.

These findings indicate an improvement in the mean preparedness scores and the accuracy of clinical interventions among anesthesia nurses following the implementation of perianesthetic emergency scenario-based simulation training.

The following section presents an analysis of the questionnaire items.

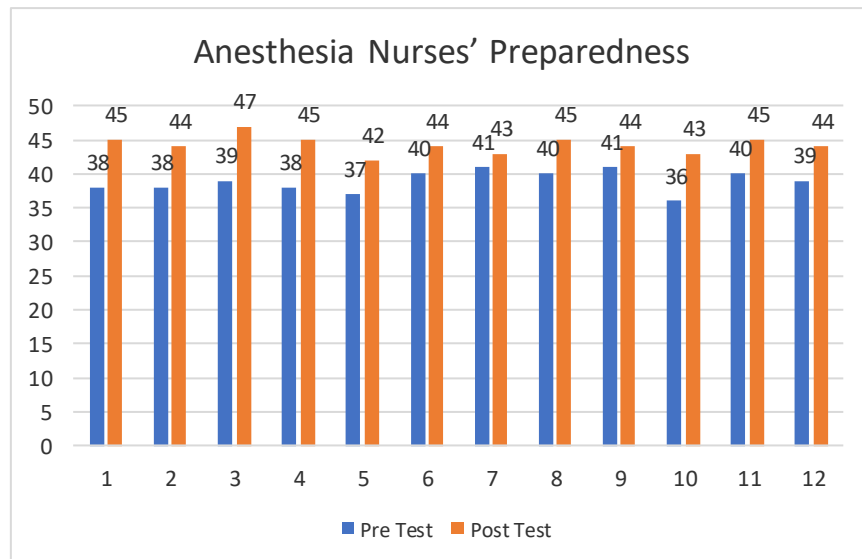


Figure 1. Item-Level Analysis of Anesthesia Nurses' Preparedness Questionnaire Responses

Base on figure 1. the accuracy of clinical interventions generally improved after the scenario-based simulation training. The most notable improvements were observed in Items 1 and 8, each increasing by three points, while most other items either showed slight improvements or maintained the maximum score. Only Item 13 showed no improvement, remaining unchanged at a relatively lower score compared to the other items. Overall, the findings indicate that the training enhanced participants' accuracy in performing clinical interventions.

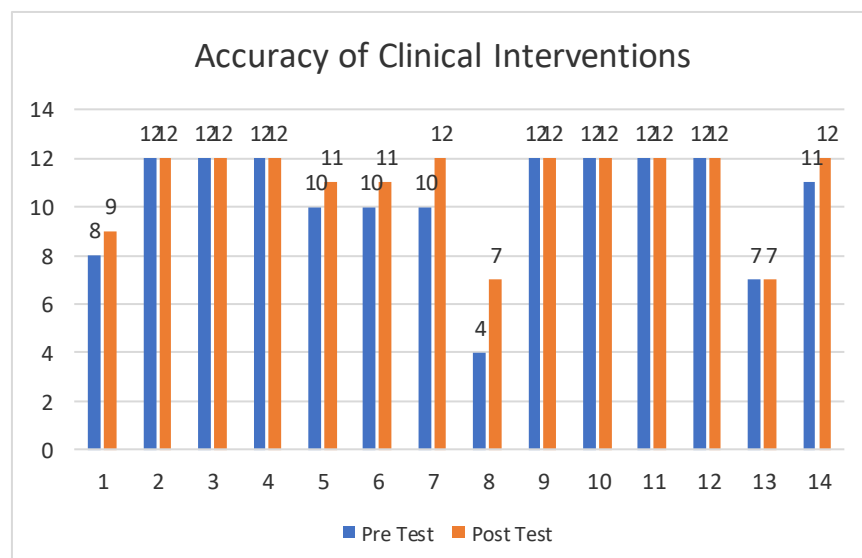


Figure 2. Analysis of Questionnaire Items Assessing the Accuracy of Clinical Interventions Among Anesthesia Nurses

Based on Figure 2, the accuracy of clinical interventions improved following the scenario-based simulation training. The greatest improvements were observed in Items 1 and 8, where the scores increased from 9 to 12 and from 4 to 7, respectively. Several other items showed slight

improvements, including Items 5, 6, and 14, each increasing by one point. In contrast, Item 13 showed no improvement, remaining at a score of 7 in both the pre-test and post-test. Most of the remaining items maintained the maximum score of 12 throughout the study, indicating consistently high performance. Overall, the findings suggest that the training effectively enhanced the accuracy of clinical interventions, particularly in areas where participants initially demonstrated lower performance.

Table 3.
Effects of Perianesthetic Emergency Scenario-Based Simulation Training on Preparedness and Accuracy of Clinical Interventions Among Anesthesia Nurses

Variable	n=12			
	Mean $\pm$ SD	Δ Mean	SE	P Value
Anesthesia Nurses' Preparedness				
Pre Test	38,91 $\pm$ 8,20	5.33	1.85	0,015
Post Test	44,25 $\pm$ 3,69			
Accuracy of Anesthesia Nurses' Clinical Interventions				
Pre Test	12,00 $\pm$ 1,47	0,75	0,30	0,032
Post Test	12,75 $\pm$ 1,05			

Based on the results of the paired t-test presented in table 3, there was an improvement in anesthesia nurses' preparedness scores following the implementation of perianesthetic emergency scenario-based simulation training. The mean preparedness score increased from 38.91 $\pm$ 8.20 at pre-test to 44.25 $\pm$ 3.69 at post-test, with a mean difference (Δ Mean) of 5.33. Statistical analysis revealed a p-value of 0.015 ($p < 0.05$), indicating that perianesthetic emergency scenario-based simulation training had a statistically significant effect on improving anesthesia nurses' preparedness. Similarly, the accuracy of anesthesia nurses' clinical interventions also improved following the intervention. The mean score increased from 12.00 $\pm$ 1.47 at pre-test to 12.75 $\pm$ 1.05 at post-test, with a mean difference (Δ Mean) of 0.75. The statistical analysis yielded a p-value of 0.032 ($p < 0.05$), demonstrating that perianesthetic emergency scenario-based simulation training had a statistically significant effect on enhancing the accuracy of anesthesia nurses' clinical interventions.

DISCUSSION

These findings are consistent with the study by Liu et al., which reported that simulation training significantly improved perioperative nurses' emergency response competencies by enhancing their knowledge, skills, and readiness to manage critical situations (Liu et al., 2026). Similar findings were reported by Motola et al., who demonstrated that scenario-based simulation enhances nurses' preparedness for perioperative critical events by enabling participants to integrate theoretical knowledge and clinical practice simultaneously (Motola et al., 2020).

The improvement in the accuracy of clinical interventions observed in this study indicates that simulation training contributes not only to knowledge acquisition but also to the ability to translate knowledge into appropriate clinical actions (Finstad, 2024). In the context of perianesthetic emergencies, the accuracy of interventions largely depends on nurses' ability to perform rapid assessments, prioritize patient needs, and implement evidence-based interventions according to established standards. Simulation allows participants to repeatedly practice clinical procedures in a structured manner, thereby strengthening procedural memory and psychomotor skills (Rineau et al., 2021). According to Cant and Cooper, simulation-based learning has been shown to improve clinical performance, technical skills, and decision-making abilities compared with conventional educational methods (Cant & Cooper, 2020). Furthermore, Gao et al. reported that repeated simulation exercises enhance intervention accuracy and reduce errors in nursing procedures (Gao et al., 2021).

The statistically significant effects of simulation training on both preparedness and intervention accuracy support experiential learning theory, which emphasizes the importance of direct

experience in competency development. Through simulation, participants actively engage in problem-solving, clinical decision-making, team communication, and performance evaluation during debriefing sessions rather than passively receiving information. These activities facilitate the development of critical thinking skills that are essential for managing emergency situations. Lateef stated that simulation serves as an effective educational strategy for bridging the gap between theoretical knowledge and clinical practice because learners are exposed to experiences that closely resemble real-world situations (Lateef, 2010). This perspective is supported by Rutherford-Hemming et al., who reported that simulation-based nursing education consistently improves clinical competence and workforce readiness among healthcare professionals (Wunder et al., 2020).

The findings of this study also support recommendations from professional organizations and international institutions that emphasize simulation training as an important strategy for improving patient safety. Standards developed by INACSL indicate that systematically designed simulation programs can enhance both individual and team competencies in managing high-risk, low-frequency events, including anesthesia-related emergencies (INACSL, 2021). The researchers assume that perianesthetic emergency scenario-based simulation training provides learning experiences that closely resemble actual clinical situations, thereby improving anesthesia nurses' preparedness and the accuracy of their clinical interventions during emergency events in the operating room. Through simulation, nurses can practice recognizing signs of clinical deterioration, performing rapid assessments, and making appropriate decisions without compromising patient safety.

The improvement in preparedness observed after the intervention may be associated with increased knowledge, self-confidence, and anticipatory abilities regarding potential complications that may arise during the perianesthetic period. Meanwhile, the improvement in intervention accuracy suggests that simulation training not only strengthens cognitive competencies but also facilitates the integration of knowledge, technical skills, and critical thinking into clinical practice.

The researchers further assume that the respondents' characteristics—predominantly young adult nurses with professional-level education and relatively short work experience—may have facilitated their ability to engage with active learning strategies and adopt new competencies acquired during the training program. Therefore, perianesthetic emergency scenario-based simulation training may serve as an effective strategy for enhancing clinical competence, strengthening clinical decision-making, and promoting patient safety in the operating room.

Based on the preparedness questionnaire results, all items demonstrated increased scores following the implementation of perianesthetic emergency scenario-based simulation training. However, several items showed relatively smaller improvements compared to the others. The lowest increase was observed in Item 6, "I know the initial actions required when a patient experiences a decrease in blood pressure," with the score increasing from 40 at pre-test to 44 at post-test. In addition, Item 7, "I am able to use airway support devices according to patient needs," increased from 41 to 43, while Item 12, "I feel prepared to manage perianesthetic emergency situations," increased from 39 to 44. These findings suggest that specific emergency management competencies, particularly those related to hemodynamic management and the use of airway support devices, still require further reinforcement despite the overall improvement in preparedness following the training intervention.

The researchers assume that the improvement observed across all preparedness components indicates that scenario-based simulation is effective in enhancing anesthesia nurses' understanding and readiness to respond to critical situations. Nevertheless, the relatively smaller increases in items related to hypotension management and airway support device utilization may be attributed to the fact that these competencies require more extensive clinical exposure, repetitive practice, and experience with a broader range of perianesthetic emergency scenarios. While cognitive

understanding of appropriate interventions may improve following training, psychomotor skills and clinical decision-making abilities generally require continuous learning and repeated simulation practice to achieve optimal proficiency.

Based on the results presented in Figure 2, several indicators demonstrated improved scores between the pre-test and post-test following the scenario-based simulation training intervention. The most substantial improvement was observed in Item 8, “Identifying a decrease in blood pressure,” where the score increased from 4 at pre-test to 7 at post-test, representing a three-point improvement. This finding suggests that participants’ ability to recognize hemodynamic disturbances was relatively limited before the training, possibly because acute hypotensive events are not frequently encountered in routine clinical practice and therefore require more specialized clinical competencies. Through scenario-based simulation, participants gained direct experience in recognizing signs of hypotension, performing rapid assessments, and determining appropriate interventions. Improvements were also observed in Item 10 (“Preparing intravenous fluids”), Item 11 (“Reporting patient conditions”), and Item 14 (“Demonstrating rapid response”), indicating enhanced ability to manage hemodynamic emergencies in a systematic and coordinated manner.

In contrast, several items demonstrated only modest improvements. For example, Item 1 (“Identifying decreased oxygen saturation”) increased from a score of 8 to 9. The relatively small improvement may be attributed to the participants’ already strong baseline competency in recognizing oxygen desaturation, as this skill is routinely performed in anesthesia practice. Similarly, Item 13 (“Coordinating with the team”) showed no change, with a score of 7 at both pre-test and post-test. This may indicate that teamwork and coordination skills were already well established prior to the intervention, or alternatively, that these competencies require training approaches with a greater emphasis on interprofessional communication and teamwork. Likewise, the limited improvements observed in Item 2 (“Assessing airway condition”), Item 5 (“Monitoring patient condition”), and Item 9 (“Monitoring vital signs”) may be explained by participants’ relatively high baseline proficiency in these routine anesthesia-related activities.

Based on these findings, it can be assumed that scenario-based simulation training effectively enhances both preparedness and the accuracy of clinical interventions among anesthesia nurses, particularly for competencies related to recognizing and managing less frequently encountered emergencies, such as hypotension recognition (Item 8) and rapid emergency response (Item 14). Simulation provides a learning experience that closely resembles real clinical situations, enabling participants to integrate cognitive, psychomotor, and communication skills within a single sequence of clinical actions. However, to maintain and further improve performance across all indicators, including Item 13 (“Coordinating with the team”), which showed no measurable improvement, ongoing training through regular simulation exercises, structured debriefing and feedback sessions, and consistent competency evaluations using standardized checklists is recommended. Such approaches are expected to strengthen anesthesia nurses’ ability to provide rapid, systematic, and appropriate responses to perianesthetic emergencies involving both airway and hemodynamic disturbances.

CONCLUSION

Based on the findings of this study, it can be concluded that perianesthetic emergency scenario-based simulation training is effective in improving the preparedness and accuracy of clinical interventions among anesthesia nurses when managing emergency situations. The training enhanced nurses’ ability to respond to critical events, make appropriate clinical decisions, and perform interventions more accurately according to patient needs.

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