CODE BLUE SIMULATION TRAINING: EFFECTS ON NURSE SELF-CONFIDENCE AND SATISFACTION

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Abstract: Cardiac arrest remains a critical emergency in hospital settings, requiring nurses to possess high levels of competence and confidence. Simulation-based education has been recognized as an effective method for enhancing clinical skills while maintaining patient safety. Using a mixed-method sequential explanatory design, this study evaluated Code Blue Simulation (CBS) training on the performance and confidence among nurses. Conducted at Gleneagles JPMC in Brunei Darussalam. Purposive sampling was used to recruit the nurses. This study involved three main phases: first, the Code Blue Simulation (CBS) programme development; secondly, the quantitative phase; and thirdly, the qualitative phase, preceding the quantitative phase, allowing for an in-depth exploration of participants' experiences to explain the statistical findings, thereby enhancing the interpretation and applicability of the results. Data were collected using the National League for Nursing (NLN) Satisfaction and Self-Confidence Survey (2005) and the code blue observation tool and analysed using descriptive statistics and t-tests. The qualitative component uses semi-structured interviews and thematic analysis. The study adhered to ethical standards, securing institutional review board approval, obtaining informed consent for voluntary participation, and maintaining strict confidentiality and anonymity throughout the research. Participants reported high levels of satisfaction and self-confidence across all domains, with mean scores ranging from 4.271 to 4.743. Instructed autonomy, facilitator guidance, and learner autonomy were highly rated. All statistical analyses were significant ($p < .001$), indicating a positive impact of the CBS programme on perceived learning outcomes. Code Blue Simulation (CBS) training effectively enhances nurses' satisfaction with learning and self-confidence, promoting critical thinking, clinical judgement, and preparedness for real-life cardiac emergencies. Integration of standard simulations into ongoing professional development is recommended to strengthen patient safety and nursing competence.

Keywords: Cardiorespiratory arrest, code blue simulation, nursing education, satisfaction, self-confidence.

1. Introduction

1.1 *Cardiopulmonary Incident*

In-hospital cardiac arrest survival rates globally remain below 25%, despite resuscitation advancements (AHA, 2022 & Panchal et al. (2020)). Early recognition and prompt nursing response, demonstrating competence and rapid decision-making, are crucial. Simulation-based education offers a safe, effective way to prepare nurses for complex emergencies (Jeffries, 2005). AHA (2013b) recommends defibrillation within two minutes for shockable rhythms and assisted ventilation within one minute, emphasising early detection and "code blue" activation.

The purpose of this study is to evaluate the impact of a Code Blue Simulation (CBS) programme on nurses' code blue response time, self-confidence, and satisfaction. This will be achieved through specific objectives: first, developing and evaluating the CBS programme using Delphi techniques and learning needs analysis, and second, assessing its effectiveness by comparing the knowledge, skills, and confidence in code blue response between an intervention group and a non-intervention group.

The simulation program addresses issues like unfamiliarity with equipment, difficulty locating supplies, and team synergy. AHA (2022) states 90% of cardiac arrest patients die, but immediate CPR can double

or triple survival. Implementing resuscitation guidelines and a code blue team are key factors (Penketh & Nolan, 2022). Nurses must have the necessary ability, knowledge, and attitude for these situations. In Brunei Darussalam, tertiary cardiac hospitals like Gleneagles Jerudong Park Medical Centre face challenges ensuring nurses' preparedness. Limited real-life exposure necessitates structured simulation training to replicate emergencies and promote learning, confidence, critical thinking, judgement, and teamwork, aligning with international standards (AHA, 2022; NLN, 2005).

1.2 *Problem Statement*

Despite the proven benefits of simulation-based training, there remains a gap in knowledge regarding its effectiveness in improving nurses' satisfaction and self-confidence in Brunei's tertiary cardiac hospitals. Evidence suggests that while nurses may acquire theoretical knowledge, the translation to applied skills under high-pressure situations is inconsistent without structured practice (Matson, 2023; Nusser, 2021). Moreover, variations in simulation program design, instructional quality, and learner engagement may influence the degree to which participants perceive competence and confidence (Jeffries, 2012).

1.3 *Knowledge Gap*

Although numerous studies have examined simulation in nursing education, there is limited evidence specifically evaluating Code Blue Simulation (CBS) programmes in Brunei. Existing research has predominantly focused on student nurses or general clinical skills, with fewer studies assessing registered nurses' perceptions of satisfaction and self-confidence in managing life-threatening cardiac events (Jeffries, 2005; NLN, 2005). Furthermore, while global guidelines such as those from the AHA emphasise the importance of competence in resuscitation, local data assessing training outcomes in the Brunei healthcare context are sparse, creating a critical gap in evidence-based nursing education and patient safety initiatives.

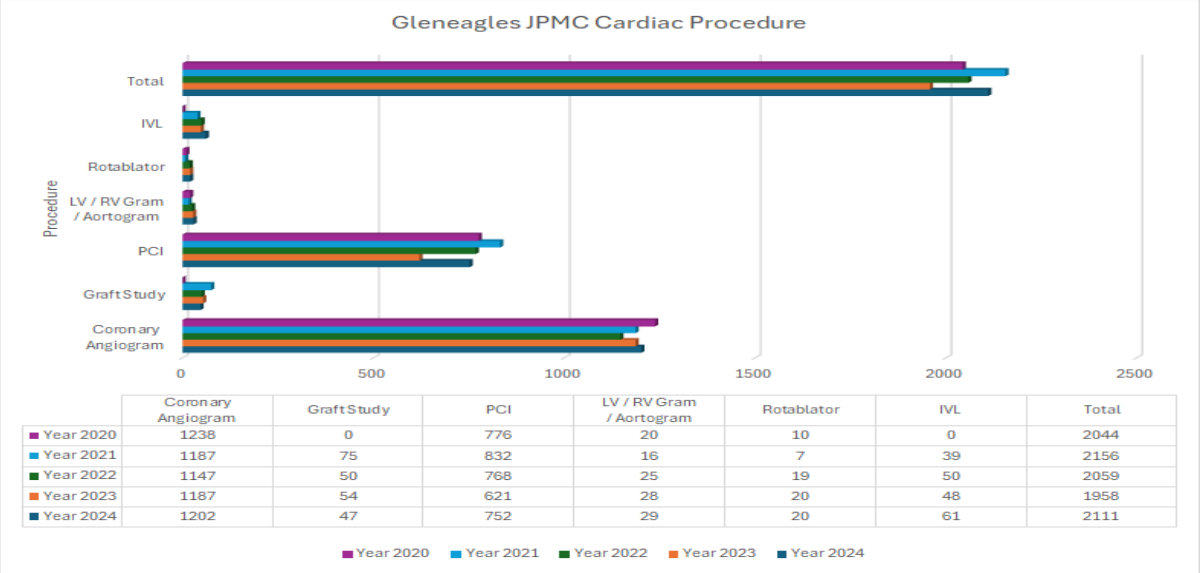
1.4 *Theoretical Framework*

This study is guided by the Jeffries Simulation Theory, which underscores the importance of structured simulation design, clear learning objectives, facilitator guidance, and learner engagement to achieve educational outcomes (Jeffries, 2012).

According to the framework, effective simulation not only enhances knowledge and skills but also fosters learner satisfaction, confidence, and critical thinking. Applying this framework to the CBS program allows for systematic evaluation using Kirkpatrick & Kirkpatrick (2006) for interpreting outcomes of the program and using NLN (2005) to evaluate the nurses' satisfaction and self-confidence

1.5 *Study Purpose*

The purpose of this study was to evaluate the effectiveness of Code Blue Simulation training on nurses' satisfaction with learning and self-confidence in clinical performance in a tertiary private cardiac hospital in Brunei Darussalam. The study addresses the gap in localised evidence, contributes to nursing education literature, and aligns with AHA (2025) recommendations on competency-based resuscitation training.



	Coronary Angiogram	Graft Study	PCI	LV / RV Gram / Aortogram	Rotablator	IVL	Total
Year 2020	1238	0	776	20	10	0	2044
Year 2021	1187	75	832	16	7	39	2156
Year 2022	1147	50	768	25	19	50	2059
Year 2023	1187	54	621	28	20	48	1958
Year 2024	1202	47	752	29	20	61	2111

Year 2020 Year 2021 Year 2022 Year 2023 Year 2024

Figure 1: Gleneagles JPMC Cardiac Procedure

1.6 *Learning Need Analysis*

Despite receiving AHA training, nurses demonstrated significant shortcomings in performance and confidence during Code Blue events. Incident reports, drills, and staff feedback consistently highlighted issues such as confusion over roles, delays in task execution, and increased anxiety under pressure. Given this variability in skill retention and application, particularly in high-stress situations, a structured, simulation-based training approach is essential. This training is necessary to enhance clinical competence, teamwork, communication, and emotional preparedness for cardiac emergencies. As GJPMC handles a high volume, approximately 2000 cardiac procedures annually (2025), the staff must maintain readiness to manage cardiac emergencies at any moment.

1.7 *Code Blue Management*

GJPMC (2022) strengthened the standard operating procedure (SOP) for Code Blue management and the rapid response team (RRT). This initiative involved implementing the CBS programme and regularly conducting standard code blue drills. As a result, staff achieved a better understanding of code blue management, and the drills provided practical opportunities to learn the correct procedures. This ensures staff competency in managing this emergency, which ultimately benefits both patients and their families.

1.8 *Code Blue Readiness and Self-Confidence*

A survey, using a tool adapted from Nusser (2021), assessed overall nurses' self-reported readiness and confidence in Code Blue management that acts as one of the learning needs analysis surveys. Only 45 out of 100 distributed questionnaires were returned, mostly from critical care staff. While many felt prepared, some lacked confidence, particularly regarding defibrillator use, SBAR, and scribing. Crucially, most (68.8%) identified Code Blue drills as vital for preparedness, emphasising the value of simulation training.

The survey showed that nurses generally felt confident in managing Code Blue events, especially with physical tasks like using the crash cart and performing chest compressions. However, it shows lower confidence in using the defibrillator and scribing. Most agreed that simulations and debriefings help maintain their readiness, highlighting the importance of continued training.

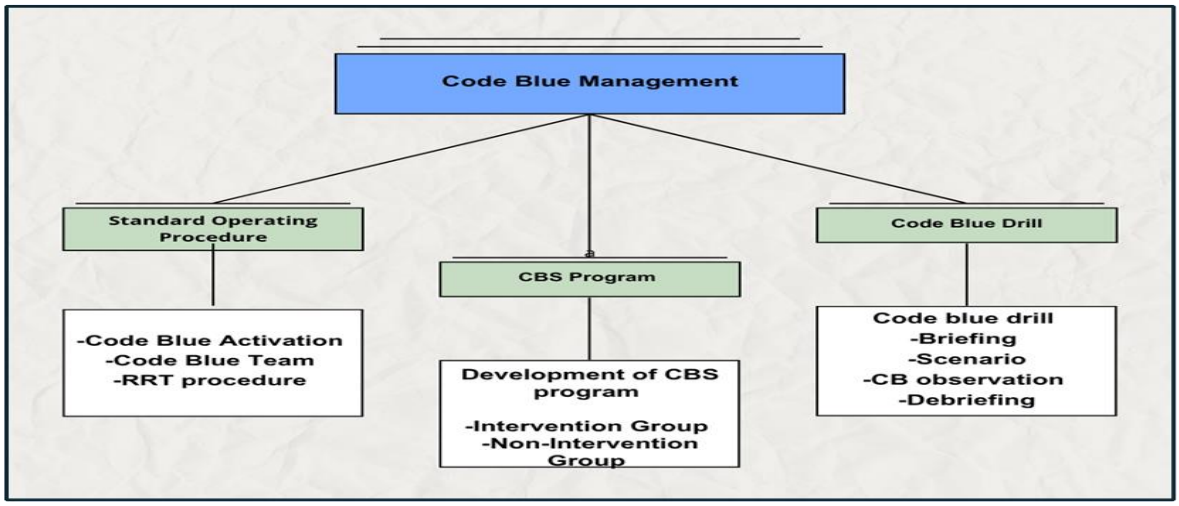


Figure 2: Code Blue Management, GJPMC (2022)

1.9 *Code Blue Observation and Debriefing Form.*

The programme equipped participants with the necessary knowledge and skills for prompt, effective recognition and response to a code blue event. Facilitators observed and evaluated participants using a checklist adopted from the GJPMC (2022) code blue observation form debriefing form, ensuring they met the AHA (2013b) response time guidelines.

Post-drill, a debriefing session provided two-way feedback. Evaluating this debriefing is crucial for improving team performance, communication, and patient outcomes after cardiac arrest or a life-threatening emergency. These sessions identify strengths and areas for improvement, as illustrated by the ADDIE Model (Branch, 2009). Assessors utilise reflective thinking to learn from their experiences.

1.10 *Early Response Time.*

To maintain staff proficiency in the nine crucial code blue steps (including activation, trolley retrieval, chest compression, pad placement, and defibrillation/AED use), researchers advise conducting drills at least every other month in low-incidence areas. Early intervention is vital for improved patient outcomes and preventing hypoxia.

This study assessed the Code Blue Simulation (CBS) programme's impact on response times, targeting CPR within one minute and defibrillation within two minutes. Pre-CBS, 7.7% failed both targets; post-CBS, all groups achieved 100% compliance, proving simulation training effectively translates knowledge to clinical practice. Integrating CBS training is recommended for upholding high code blue management standards.

2. Tables and Figures

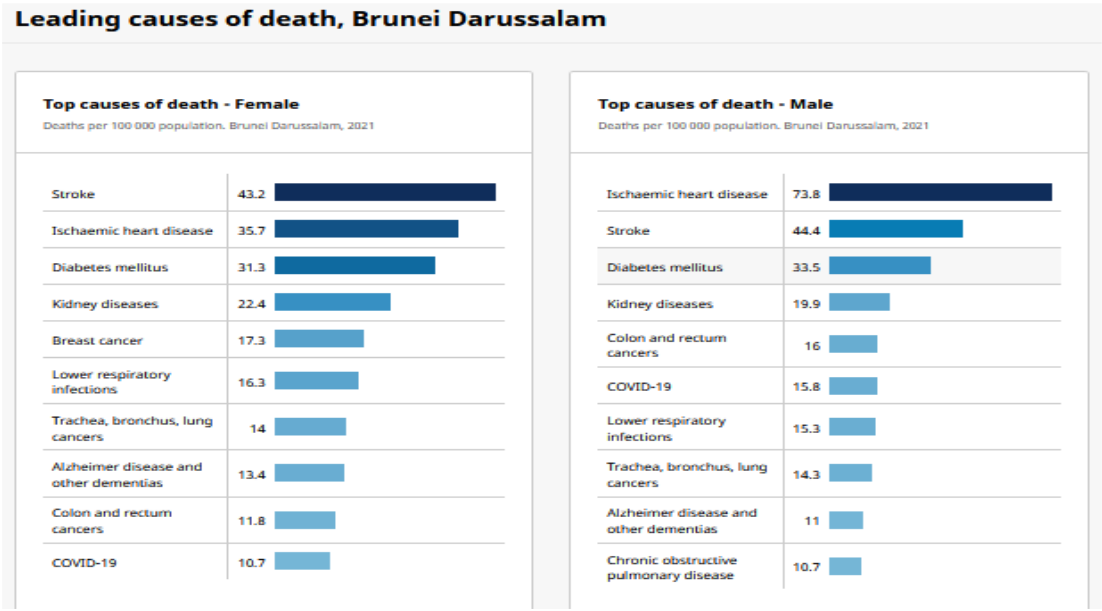


Figure 3: Leading Cause of Death in Brunei (Health data overview for Brunei Darussalam, 2021)

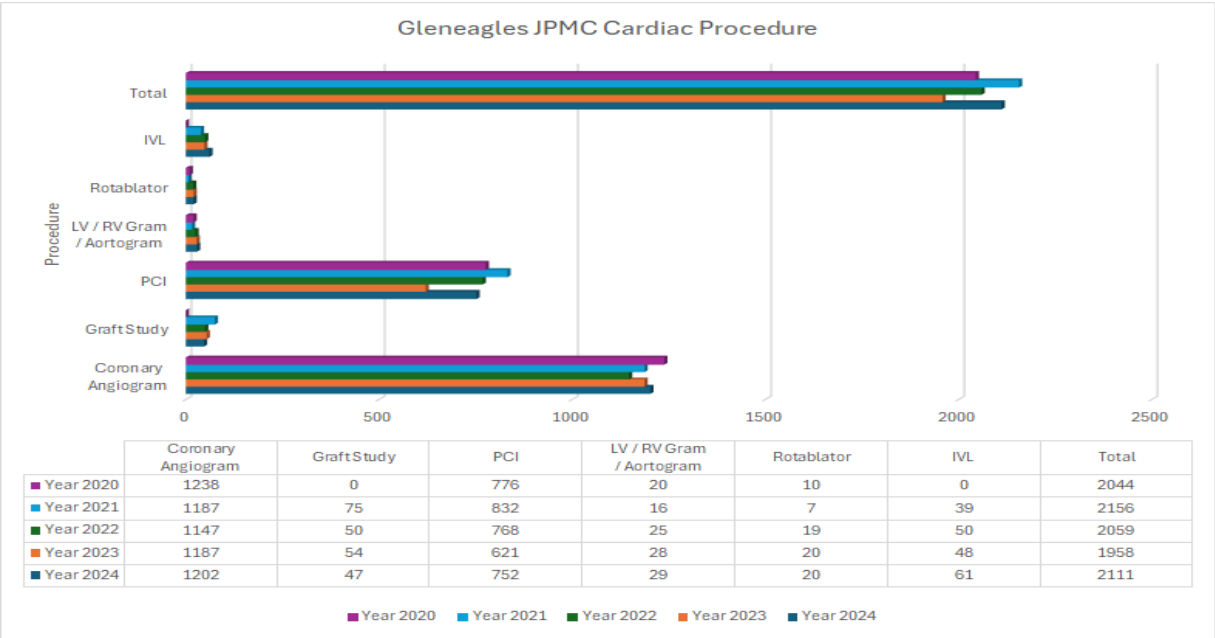


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Figure 4: GJPMC Cardiac Procedure, GJPMC, (2025)

The context in Brunei Darussalam further underscores this issue, as cardiovascular disease was the leading cause of death in 2021, accounting for 26% of all mortalities (Lyna, 2022). The staff preparation in managing code blue is vital in reducing the mortality rate.

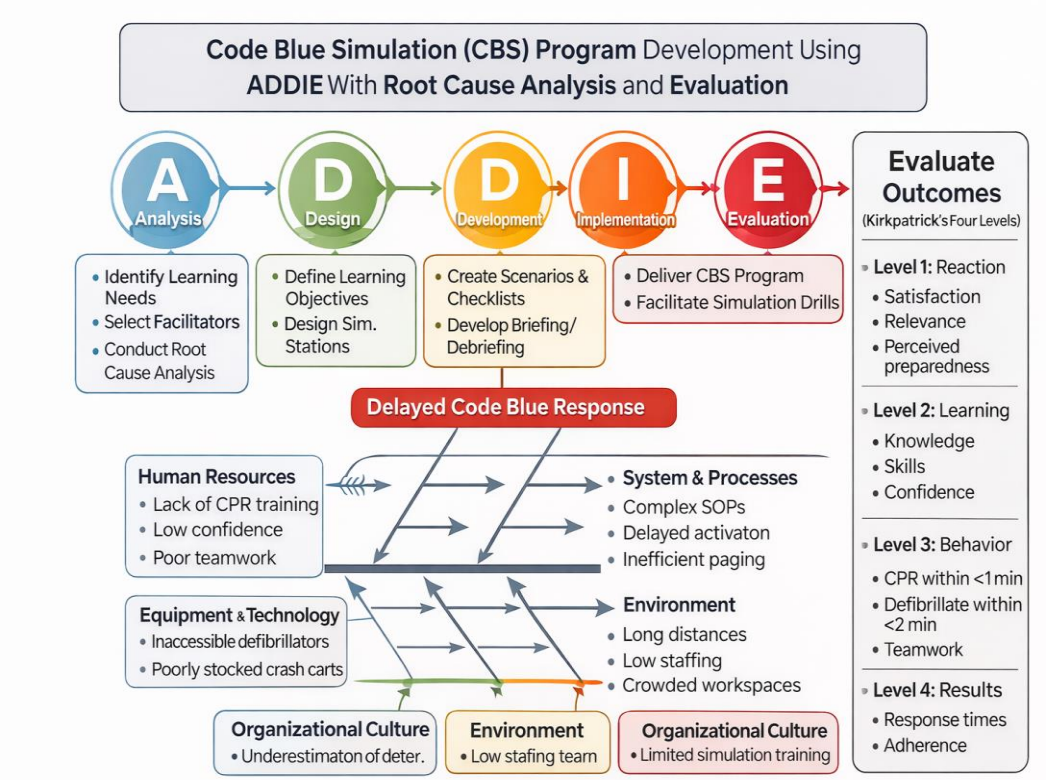


Figure 5: Code Blue Simulation (CBS) Program Development (Branch, 2009; Kirkpatrick & Kirkpatrick, 2006).

2.1 *Code Blue Simulation Program*

The programme was developed using the ADDIE model (Branch, 2009) integrated with root cause analysis. Analysis involved reviewing AHA guidelines, SOPs, and event feedback, validated by an expert panel. Design utilised the Delphi technique to prioritise topics. Development included creating standardised scenarios (based on adult cardiac arrest algorithms), checklists, facilitator training, and logistics. Evaluation of the CBS programme using Kirkpatrick's Four Levels by Kirkpatrick & Kirkpatrick (2006).

3.0 Equation

3.1 *Methods and Discussion*

This study utilised a mixed-method sequential explanatory design to assess the impact of Code Blue Simulation (CBS) training on nursing performance and confidence. This study has been reviewed and approved by the UiTM Research Ethics Committee, which operates following the ICH Good Clinical Practice Guidelines. Malaysian Good Clinical Practice Guidelines and the Declaration of Helsinki. With the reference number of REC/11/2023 (PG/MR/444). The methodology was structured into three main primary phases.

3.1.1 Phase One, Code Blue Simulation Program Development

In this phase, the CBS programme was developed using Delphi techniques and the ADDIE model framework. In the Delphi technique, the AHA guidelines in the management of adult cardiac arrest and involvement of the code blue expert panel have been used. The programme development framework is integrated with the ADDIE model, which consists of five sub-phases. Analysis: Reviewed AHA guidelines, standard operating procedures (SOPs), and feedback from previous events; integrated expert panel feedback and learning needs analysis feedback for code blue readiness. Design: Used the Delphi technique to prioritise relevant topics for the training. Development: Involved creating standardised

scenarios (based on adult cardiac arrest algorithms that regularly happened in GJPMC), checklists, and training for code blue facilitators. Implementation: Conducted training across four stations: cardiorespiratory resuscitation (CPR), airway management, preparation and administration of emergency medication, and defibrillation. Evaluation: The programme's outcomes were interpreted using Kirkpatrick's four-level evaluation framework.

3.1.2 Phase Two: Quantitative Phase

This phase was conducted to evaluate the effectiveness of the CBS programme through statistical data that involved participants, i.e., 140 nurses were recruited via purposive sampling and divided into intervention and non-intervention groups. Data Collection: Researchers used the code blue observation form to assess the nurses' competence in code blue management and the procedure competency checklist in each station. Meanwhile, in assessing satisfaction and confidence, the researcher adopted the Satisfaction and Self-Confidence Survey from the National League for Nursing (NLN, 2005). Analysis: Data were analysed using descriptive statistics and t-tests. Focus: This second phase assessed knowledge, skills, and confidence levels before and after the simulation training.

3.1.3 Phase Three: Qualitative Phase

Following the quantitative analysis, the qualitative phase was implemented to gain a richer understanding of the numerical outcomes. Data Collection: Semi-structured interviews were conducted with 14 conveniently selected informants from the intervention group, adopting the approach described by Schedina et al. (2019). Analysis: The collected data were subjected to thematic analysis. This third phase focused on exploring the participants' lived experiences and perceptions. This approach was essential for explaining the statistical findings and improving the overall interpretation of the study's results.

4. Result and Discussion

A survey, adopted from Nusser (2021), had a total of 100 questionnaires distributed, but only 45 staff answered the code blue readiness and confidence survey. Participants were primarily from the critical care unit (53%), with others from medical/surgical units (8.8%), outpatient clinics (13.3%), and other units (24.4%). The majority felt prepared for a code blue, likely reflecting the high critical care participation.

However, the results indicated lower staff confidence in using the defibrillator, SBAR, and scribing during a code blue. Alarmingly, 68.8% of participants felt their code blue readiness could be improved by participating in drills, suggesting a need for enhanced competency and confidence, especially for staff who were less frequently exposed to code blue events.

Table 1: Code Blue Readiness and Self-Confidence Scores (n = 45) (Nusser, 2021)

Question	Mean	SD	Med	Min	Max
I feel confident in and prepared for a code blue.	4.04	0.73	4	2	5
I feel confident in recognising and calling in a code blue.	4.28	0.67	4	3	5
I feel confident providing and assessing high-quality chest compression during a code blue.	4.04	0.91	4	2	5
I feel confident administering ventilation with a bag-valve mask/manual respiratory code blue.	4.28	0.73	4	3	5
I feel confident bringing the crash cart/ET trolley and applying a backboard under the patient during a code blue.	4.11	0.79	4	2	5
I feel confident monitoring vital signs and heart rhythm during a code blue.	4.40	0.68	5	3	5
I feel confident operating the defibrillator during a code blue.	4.00	0.82	4	2	5
I feel confident in providing an SBAR handoff to the code blue team.	3.86	1.01	4	1	5
I feel confident scribing during a code blue until the code blue team arrives at the scene.	4.16	0.82	4	2	5
Participating in simulated crisis scenarios and team debriefing is beneficial to maintaining my code blue readiness.	4.46	0.71	5	2	5

Note: Items were measured on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). SD = standard deviation

4.1 *Satisfaction with Learning and Self-Confidence*

The Code Blue Simulation programme significantly boosted participants' learning satisfaction and clinical self-confidence, reflected in consistently high survey scores. The programme effectively enhanced knowledge, skills, and emergency preparedness. Following Jeffries' simulation theory (2012), the structured, realistic design, facilitator guidance, and active engagement contributed to positive outcomes.

High ratings for instructor support, clear objectives, and teaching cues indicate a strong instructional framework. High learner autonomy scores suggest effective self-directed learning, improving critical thinking. The programme's alignment with American Heart Association guidelines (2013b) reinforces its clinical relevance. Overall, the findings validate simulation-based education for enhancing competence, confidence, and cardiac emergency readiness, especially in Brunei.

Table 2: Code Blue Simulation: Satisfaction and Self-Confidence Results (n 70) (NLN, 2005)

Survey Item	Mean	t	P values	Interpretation
Satisfaction with Learning				
The teaching materials used in this simulation were motivating and helped me to learn	4.571	66.042	<0.001	Materials were engaging and facilitated learning
The simulation provided a variety of materials and activities promoting learning	4.514	57.777	<0.001	Diverse instructional methods were valued
I enjoyed how my instructor taught the simulation	4.743	65.440	<0.001	The instructor's teaching style was highly effective
The teaching methods were helpful and effective	4.486	52.333	<0.001	Instructional strategies supported learning
The instructor's teaching matched my learning style	4.600	59.571	<0.001	Alignment with learning preferences enhanced comprehension
Self-Confidence				
I am confident that I am mastering the simulation content	4.286	43.780	<0.001	Participants felt confident in understanding content
This simulation covered critical content for mastery	4.271	37.749	<0.001	Content perceived as relevant and comprehensive
I am developing skills and knowledge to perform clinical tasks	4.286	41.191	<0.001	Effective in building clinical skills
Instructors used helpful resources during the simulation	4.286	67.478	<0.001	Resources supported the learner. confidence
It is my responsibility to learn from the simulation	4.657	61.418	<0.001	Strong sense of learner autonomy
I know how to use simulation activities to learn skills	4.529	58.002	<0.001	Participants capable of using simulation effectively
Instructors guided what I needed to learn	4.414	46.792	<0.001	Structured instructor guidance valued
I know how to get help if I do not understand concepts	4.571	58.852	<0.001	Awareness of support systems strong
Simulation Design Scale				
I clearly understood the purpose and objectives of the simulation	4.571	58.852	<0.001	Objectives were clear and well communicated

The simulation provided enough information to problem-solve.	4.657	61.418	<0.001	Scenario design supported cognitive engagement
Cues were appropriate and promoted understanding	4.286	41.191	<0.001	Guidance enhanced learning
Confidence in applying skills in a clinical setting	4.286	41.191	<0.001	Participants felt prepared for clinical practice

Note: Items were measured using a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree).

4.2 *Code Blue Simulation and Code Blue Drill*

Implementation used four stations: CPR, airway, medication, and defibrillation, with standard scenarios like pulseless VT/VF, PEA, and asystole. Evaluation included structured observation, response time monitoring, and reflective debriefing. The training aimed to enhance clinical decision-making, team coordination, technical competence, and confidence. Qualitative interviews supported quantitative results, revealing themes of improved preparedness, teamwork, and self-assurance. Ethical standards, consent, and confidentiality were maintained.

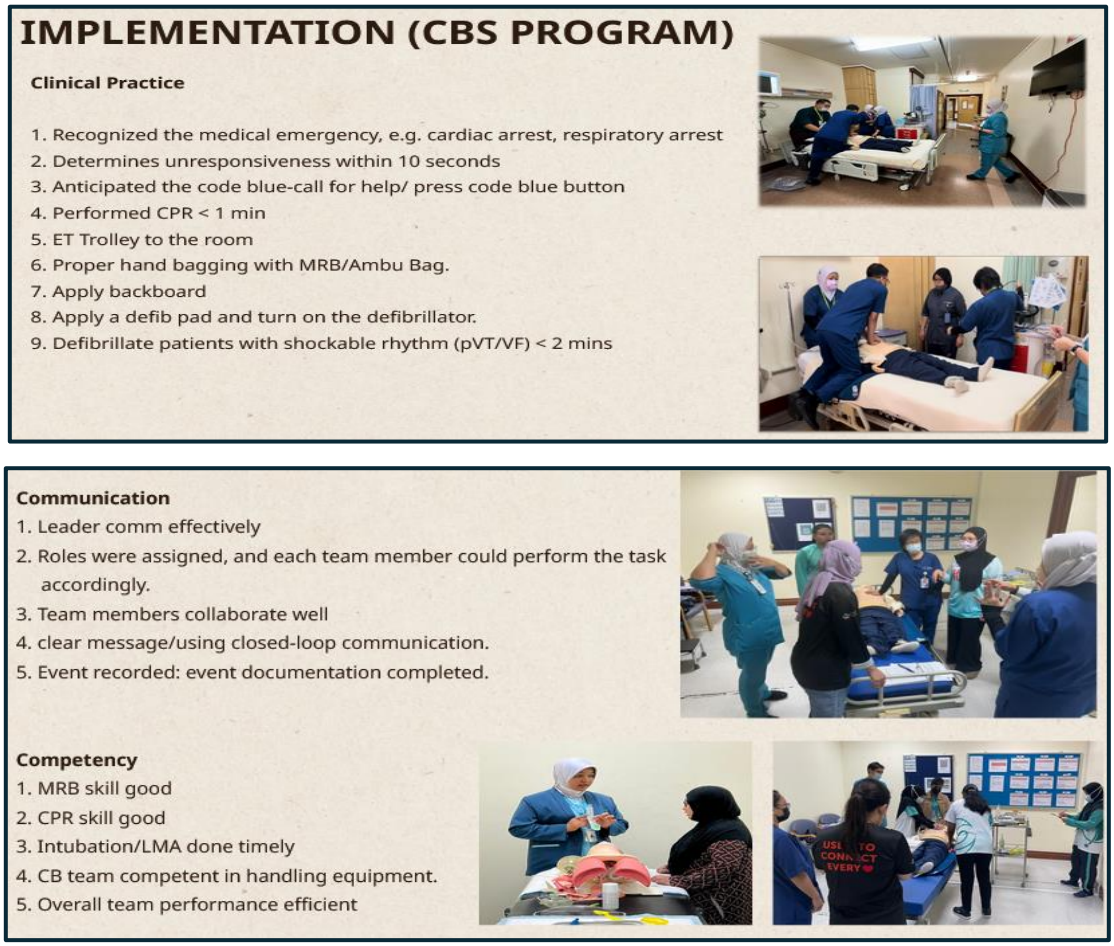


Figure 6: CBS Program and Code Blue Drill

4.3 *Implications for Nursing Practice*

The CBS programme has clear implications for nursing education and patient safety. First, by providing a controlled, realistic environment, the simulation allows nurses to practise critical interventions, refine

decision-making skills, and identify areas for improvement without jeopardising patient care. Second, the programme fosters self-confidence, an essential factor in ensuring timely, competent responses during code blue events. Third, the findings support integrating simulation-based interventions into continuous professional development programmes within tertiary cardiac hospitals.

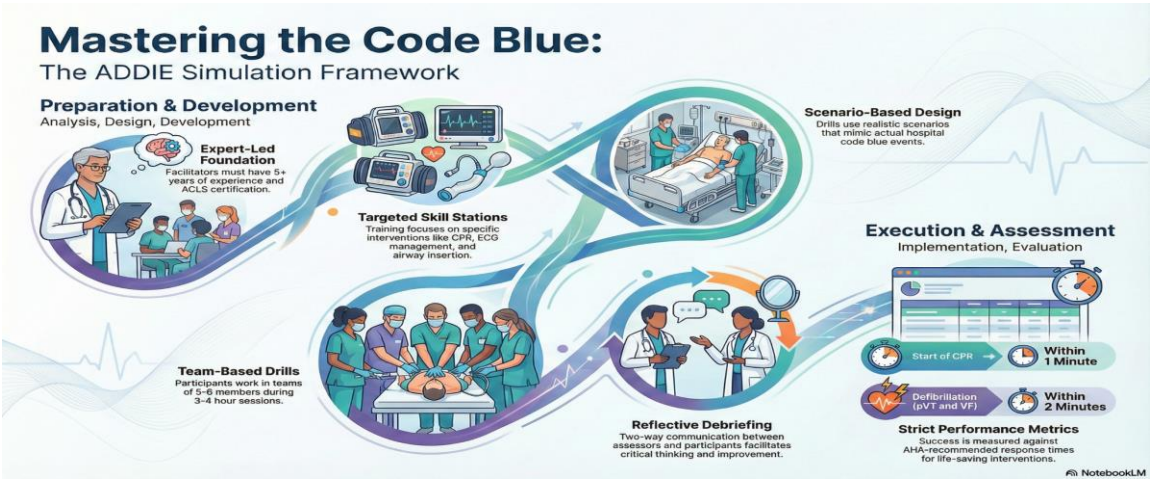


Figure 7: Benefit of Code Blue Management and Code Blue Simulation Program

Moreover, the results suggest that learner autonomy and instructor guidance must be balanced for optimal outcomes. Facilitators play a critical role in designing scenarios that challenge learners while providing structured feedback, aligning with Jeffries' Simulation Theory and international best practices (Jeffries, 2012; NLN, 2005). This study found that the CBS programme significantly improved nurses' response times, achieving 100% compliance with AHA guidelines (AHA, 2013b) for CPR within 1 minute and defibrillation within 2 minutes post-training. In contrast, in the pre-CBS programme, 7.7% of groups did not meet these targets.

Table 3: Themes and Subthemes Identified from Qualitative Findings (n 14) (Schedina et al., 2019)

Theme	Sub-theme	Description	Participant Quote
Professional Competence	Translating Theory to Practice	Simulation serves as the bridge between theoretical ACLS/BLS knowledge and real-world application.	"Code Blue simulation training transforms theory into practice."
Skill Mastery and Sharpness		Regular practice is seen as essential for maintaining and "polishing" life-saving skills.	"Regular practice is important to keep skills and knowledge sharp."
Psychological Preparedness	Confidence and Reduced Hesitation	Practising in a simulated environment helps nurses feel more self-assured and less likely to hesitate.	"Practising makes one more confident in real code blue events."
	Emotional Regulation	Training helps nurses manage the "panic" of real events and stay calm under pressure.	"The TL [Team Leader] should be knowledgeable and calm; then the teams can cool and calm too."
Learning Environment	Safety to Fail	Simulation provides a non-punitive space to learn from errors without risking patient lives.	"With simulation, it is okay to make mistakes and be evaluated."

Theme	Sub-theme	Description	Participant Quote
	Mentorship and Peer Learning	Junior staff value the opportunity to observe and learn from the behaviour of senior nurses.	"[I]...can learn from more experienced nurses on real-life code blue events..."
Operational Readiness	Role Clarity	Drills help define specific tasks so each team member knows their exact responsibility.	"To know their assignment well so they will be able to execute their task smoothly."
	Team Coordination	Training improves the "flow" and communication necessary for a timely resuscitation.	"Knowing the flow helps a lot... because practice makes perfect."
Reality vs. Simulation	Environmental Stressors	Nurses recognise that real life includes intense pressures, such as family presence, not always found in drills.	"Real events mean more panic and busyness... Relatives are around shouting and crying."
	High-Stakes Pressure	There is a profound awareness that while drills can be repeated, real life offers no second chances.	"Drill at least can repeat the action, but with real situations it will compromise the pt's [patient's] life."

In conclusion, the results indicate that simulation-based Code Blue training significantly contributes to the improvement of nurses' competence, confidence, and collaboration. The gap between simulated and real-life conditions indicates the necessity for continuous enhancement of training methodologies to more accurately reflect clinical realities and tackle contextual challenges.

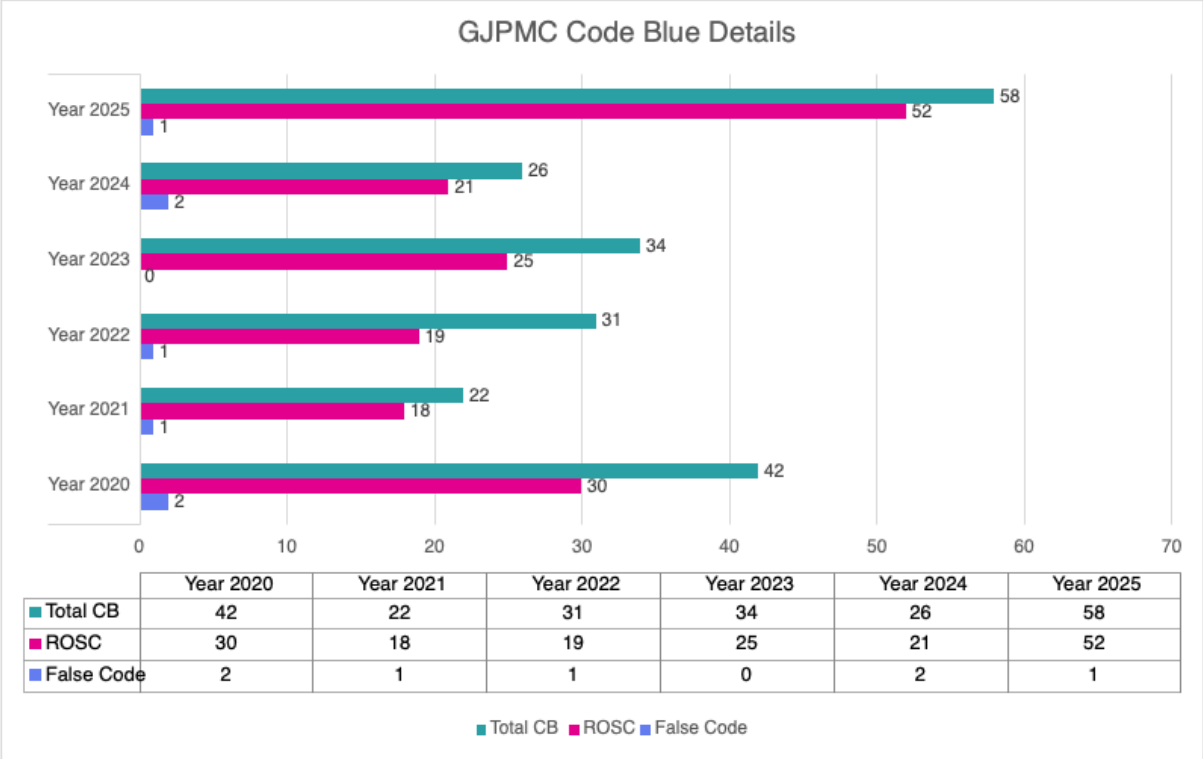
5. Conclusion

5.1 *Staff Readiness*

Code blue outcomes are strongly influenced by staff readiness, clinical judgement, teamwork, and response time. This can be improved through regular mock drills, in-situ simulation training, and organised debriefing. Jeffries (2005) has stated that reflective practice, group learning, and skill retention are all supported by simulation-based education, which is directed by well-established nursing simulation frameworks.

Meanwhile, Panchal et al. (2020) and the AHA (2022) highlight that global in-hospital cardiac arrest survival rates remain below 25%; this study provides a localised solution. By achieving 100% compliance with AHA (2013b) response time targets, i.e., CPR within one minute and defibrillation within two minutes, it demonstrates that structured simulation is a critical tool for improving the early interventions known to double or triple the survival rates. The findings support simulation-based training as an effective means of translating theoretical knowledge into clinical practice.

Regular drills are recommended to maintain skills and ensure timely intervention in improving patient outcomes (AHA, 2013b). The following finding from GJPMC shows that, in real code blue events, the percentage of return of spontaneous circulation (ROSC) increases from 68% in 2020 to 89.7% in 2025 (GJPMC, 2025). This research reinforces the findings of Nusser (2021) regarding the necessity of regular drills for maintaining sharpness and confidence while providing new evidence of the programme's effectiveness within the specific tertiary cardiac healthcare context of Brunei.



	Year 2020	Year 2021	Year 2022	Year 2023	Year 2024	Year 2025
Total CB	42	22	31	34	26	58
ROSC	30	18	19	25	21	52
False Code	2	1	1	0	2	1

Figure 8: Code Blue Details, GJPMC (2025)

5.2 *Code Blue Simulation Strength and Limitation*

A major strength of this study lies in its focus on registered nurses in a tertiary cardiac hospital, providing practical insight into simulation effectiveness within a high-acuity clinical setting. The use of the validated NLN Survey and standardised simulation scenarios enhanced the reliability and relevance of findings. However, outcomes were measured immediately after training, limiting evaluation of long-term knowledge retention and transfer to clinical practice. The single-site, purposive sample also restricts generalisability. Future research should adopt longitudinal and multicentre designs. Overall, the programme improved learning satisfaction and self-confidence while aligning with American Heart Association guidelines**.**

Code Blue simulation training was found to significantly enhance registered nurses' self-confidence and satisfaction with learning how to manage cardiac emergencies. The training aligns with both the Jeffries Simulation Theory (2012) and American Heart Association resuscitation guidelines (2025), ensuring educational rigour. Participants reported high levels of engagement, improved skill acquisition, and greater preparedness for high-acuity environments. The simulation offers a secure setting for converting theoretical knowledge into clinical skills, complemented by instructor supervision. While these outcomes are positive, future studies should investigate long-term knowledge retention, practical application in real-world settings, and wider implementation across various healthcare institutions.

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