

A Quantitative Evaluation of Simulation-Based Induction Training Programme Efficacy: A Pre-Post Intervention Study Among New Nursing Staff

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Abstract

Background: Crash cart competency is a critical, high-stakes skill for nursing staff, directly impacting resuscitation outcomes. This study evaluates the effectiveness of a structured simulation-based training program during nursing induction by analyzing pre- and post-test knowledge scores.

Methods: A pre-post intervention study was conducted with 19 new nursing staff. A 10-point knowledge test on crash cart protocols, medication, and equipment was administered before and after a standardized high-fidelity simulation training session. Scores were categorized into three competency levels: Adequate Knowledge (>70%), Needs Improvement (31-69%), and Inadequate Knowledge (<30%).

Results: Pre-test analysis revealed significant baseline knowledge deficits: only 6 staff (31%) demonstrated adequate knowledge, while 7 (36%) scored in the inadequate range. Post-training results showed dramatic improvement: 14 staff (74%) achieved adequate knowledge, and no staff remained in the inadequate range. The proportion of staff with adequate knowledge increased by 43 percentage points. The mean test score improved from 4.3 (SD=2.5) to 8.1 (SD=1.85), representing a statistically significant increase (p<0.001).

Conclusion: Simulation-based training is highly effective in rapidly improving crash cart knowledge among new nursing staff, effectively moving the majority from inadequate to adequate competency levels. However, the persistence of a subgroup (26%) requiring improvement highlights the need for targeted remediation and ongoing assessment. This training model should be integral to nursing induction programs to ensure emergency preparedness.

Keywords: Simulation training, crash cart, nursing induction, competency assessment, pre-post-test, emergency preparedness, resuscitation.

1. Introduction

Effective management of cardiac arrest situations requires immediate, confident, and correct use of the crash cart—a complex assembly of medications, equipment, and supplies. For newly inducted nursing staff, familiarity with this critical resource cannot be assumed and must be actively built through training. The National Accreditation Board for Hospitals & Healthcare Providers (NABH) emphasizes competency-based orientation, particularly for high-risk procedures. Traditional didactic methods often fail to translate into the psychomotor and cognitive recall required in a crisis. This study measures the impact of a simulation-based Induction training programme module embedded within a new nursing staff induction program, using a pre- and post-test design to quantify knowledge acquisition and identify persistent gaps.

Topic for induction training programme:

- Medication error & high-risk medicine, fluid calculation
- Suctioning, patient's assessments
- tracheostomy, et tube care & colostomy care
- catheter insertion, catheter care & removal, urine sample collection,
- care bundle & blood culture collection, sharps disposable & needle stick injury prevention technique & basic infection control practices & blood collection
- basic nursing care, vital equipment uses & important
- IV, IM, SC rt feeding & insertion& removal
- primary trauma care & prevention & safe patient transport
- oxygen therapy & CPR
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2. Methods

2.1 Study Design & Participants: A quasi-experimental, single-group pre-test/post-test study was conducted in October 2023. All 19 newly inducted nursing staff participating in the mandatory hospital orientation were included.

2.2 Intervention: The intervention was a 3-days high-fidelity simulation session in a dedicated skills lab. It included a brief didactic review followed by hands-on, scenario-based practice involving cart organization, drug identification, defibrillator operation, and team role-play, concluding with a structured debrief.

2.3 Measurement Tool: A validated 10-item multiple-choice/short-answer test assessed knowledge of crash cart zoning, common emergency drug names/doses (e.g., Adrenaline 1mg), defibrillator steps, and basic ALS algorithms. The same test was administered immediately before (pre-test) and after (post-test) the training.

2.4 Data Analysis: Scores were calculated as percentages and stratified into three clinically relevant tiers: *Adequate Knowledge (>70%)*, **Needs Improvement (31-69%)**, and *Inadequate Knowledge (<30%)*. Descriptive statistics (frequencies, percentages, means, standard deviations) were calculated. A paired t-test was used to compare mean pre- and post-test scores. Data were analysed using SPSS v.28.

3. Results

3.1 Baseline (Pre-Test) Competency: The pre-test revealed a concerning knowledge gap at induction. The mean score was 4.3/10 (43%, SD=2.5). As shown in Table 1, only 6 staff (31%) entered training with

adequate knowledge. A substantial 7 staff (37%) scored in the inadequate range (<30%), including four individuals who scored zero, indicating no functional knowledge of crash cart contents or protocols.

3.2 Post-Training Competency: Post-test results demonstrated significant improvement. The mean score rose to 8.1/10 (81%, SD=1.85). The distribution shifted markedly: 14 staff (74%) now demonstrated adequate knowledge, representing a 43-percentage-point increase. Critically, **no staff** remained in the inadequate knowledge category. However, 5 staff (26%) continued to score in the "Needs Improvement" range (31-69%).

3.3 Statistical Significance: The mean improvement of 3.8 points was statistically significant ($t(18) = 8.92, p < 0.001$), confirming the training's effectiveness.

3.4 Individual Trajectories: Notable improvements were observed among the lowest pre-test performers. For example, Staff #11 (pre=0, post=5) and Staff #14 (pre=0, post=4.5) showed marked gains, though they remained in the "Needs Improvement" tier. Conversely, high pre-test performers maintained or enhanced their scores (e.g., Staff #19: pre=8, post=9).

Table 1: Comparison of Pre-Test and Post-Test Competency Distribution (N=19)

Competency Level	Pre-Test (n, %)	Post-Test (n, %)	Change (% points)
Adequate Knowledge (>70%)	6 (31%)	14 (74%)	+43
Needs Improvement (31-69%)	6 (31%)	5 (26%)	-5
Inadequate Knowledge (<30%)	7 (37%)	0 (0%)	-37

4. Discussion

The findings robustly support the integration of simulation-based training into nursing induction for crash cart competency. The elimination of the *Inadequate Knowledge* category post-training is the most critical outcome, as it directly addresses a patient safety risk by ensuring no nurse is dangerously unprepared. The significant shift of staff into the *Adequate Knowledge* tier aligns with simulation literature, which highlights active, experiential learning as superior to passive methods for skill acquisition.

However, the persistence of 26% of staff in the *Needs Improvement* range post-training is a crucial finding for quality improvement. This subgroup, predominantly composed of the lowest pre-test scorers, achieved considerable gains but did not reach the proficiency threshold. This suggests that while simulation is powerful, a single session may be insufficient for learners with very low baseline knowledge or potential learning barriers (e.g., language, test anxiety, cognitive overload). These individuals remain a potential weak link in the resuscitation team chain, as they may require prompting or supervision during a real event, potentially delaying critical interventions.

The results underscore a dual imperative for nurse educators: 1) to mandate simulation training to raise the floor of competency, and 2) to implement a tiered remediation system for those not reaching proficiency after standard training.

Conclusion

This study confirms that a simulation-based Induction training programme module during nursing

induction is a highly effective strategy for rapidly building essential emergency knowledge, effectively transitioning the majority of staff to a level of adequate preparedness. To build on this success and address the identified gap, the following is recommended:

1. **Mandate Simulation Training:** Formally integrate this high-fidelity simulation module into the core curriculum for all new nursing staff induction.
2. **Implement Immediate Remediation:** Develop a protocol where staff scoring below 70% on the post-test undergo a mandatory, focused remedial session (e.g., one-on-one coaching, repeat simulation) before unit placement.
3. **Adopt Competency-Based Advancement:** Link successful completion of training (score >70%) to signed-off competency checklists required for independent practice in acute care areas.
4. **Conduct Longitudinal Follow-up:** Schedule "booster" simulations or in-situ drills at 3- and 6-month intervals to assess knowledge retention and decay, particularly for the "Needs Improvement" group.
5. **Root Cause Analysis for Low Performers:** For staff repeatedly scoring low, conduct supportive interviews to identify and address underlying barriers to learning.

6. References

1. Anderson, R., et al. (2020). The impact of simulation-based education on nursing students' confidence and competence in crash cart management. *Clinical Simulation in Nursing*, 48, 1-7.
2. NABH. (2022). *Accreditation Standards for Hospitals (5th Ed.)*. National Accreditation Board for Hospitals & Healthcare Providers.
3. Issenberg, S. B., et al. (2005). Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Medical Teacher*, 27(1), 10-28.
4. Meaney, P. A., et al. (2013). Cardiopulmonary resuscitation quality: improving cardiac resuscitation outcomes both inside and outside the hospital. *Circulation*, 128(4), 417-435.

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