

Bethany Norwood, BSN, RN, CCRN
Pediatric Acute Care/Primary Care DNP Candidate

Susan Connelly, DNP, APRN-NP, CPNP, PC/AC
Creighton University Faculty Advisor

BACKGROUND / SIGNIFICANCE

- Respiratory failure is the most common cause of pediatric in-hospital cardiac arrest (IHCA).
- The pediatric IHCA survival rate to discharge is 41%.
- Post-IHCA care involves an escalation of medical care, including mechanical ventilation, fluid resuscitation, and vasoactive support.
- Pediatric IHCA vs. non-IHCA patients experience nine times longer PICU stays and are at greater risk for brain injury and multi-system organ failure.
- Retention of Pediatric Advanced Life Support (PALS) resuscitation skills and knowledge declines post-training with subsequent deviation from the American Heart Association's (AHA) recommended guidelines during resuscitation events. Deviations from these guidelines are associated with poor patient outcomes.
- In 2022, the cardiac intensive care unit (CICU) at Children's Hospital Colorado had 36 cardiac arrests (CAs) (5347 patient days), or 6.7 CA/1000 patient days, a 47% increase in CAs from 2021.
- Of the 36 CAs in 2022, 20 (55%) of those arrests were due to respiratory failure or hypoxemia.

PROBLEM

Clinical deterioration is often seen before a cardiac arrest. However, there is limited, regular or refresher training to reinforce PALS education and evidence-based AHA clinical guidelines to promote rapid interventions to prevent IHCA and subsequent pediatric morbidity and mortality.

PURPOSE

To evaluate if repeated exposure to in-situ, simulation-based training could improve CICU staff's time to appropriate intervention and refine technical skills when responding to a simulated patient's respiratory decompensation.

AIMS

- To review the signs and symptoms of respiratory decompensation and reinforce PALS interventions and AHA guidelines for responding to respiratory compromise.
- To provide monthly in-situ rolling refresher simulation opportunities to expose participants to pediatric respiratory distress scenarios with high-fidelity mannequins that allow hands-on management of respiratory decompensation.
- To compare the rolling refreshers' impact on participant performance over time. Specifically, time in seconds to initiate bagging and if critical interventions (calling for help, bagging at the recommended rate with appropriate technique) were completed.
- Monitored for barriers to in-situ simulation and staff participation.

METHODS

- Setting:** Children's Hospital Colorado 22-bed CICU.
- Sample:** 68 CICU RNs.
- Intervention:** Monthly rolling refresher in-situ simulations focusing on pediatric respiratory decompensation.
- Data Collection:** Time in seconds to initiate bagging and whether critical interventions (calling for help, bagging at the recommended rate with appropriate technique). The simulation experiences were unannounced and occurred in an unoccupied CICU room during the RN's scheduled shift. Implementation 9/11/2023-12/10/2023.
- Data Analysis:** Generalized linear mixed models for rolling refresher scores and descriptive statistics for demographics using percentages and frequencies.

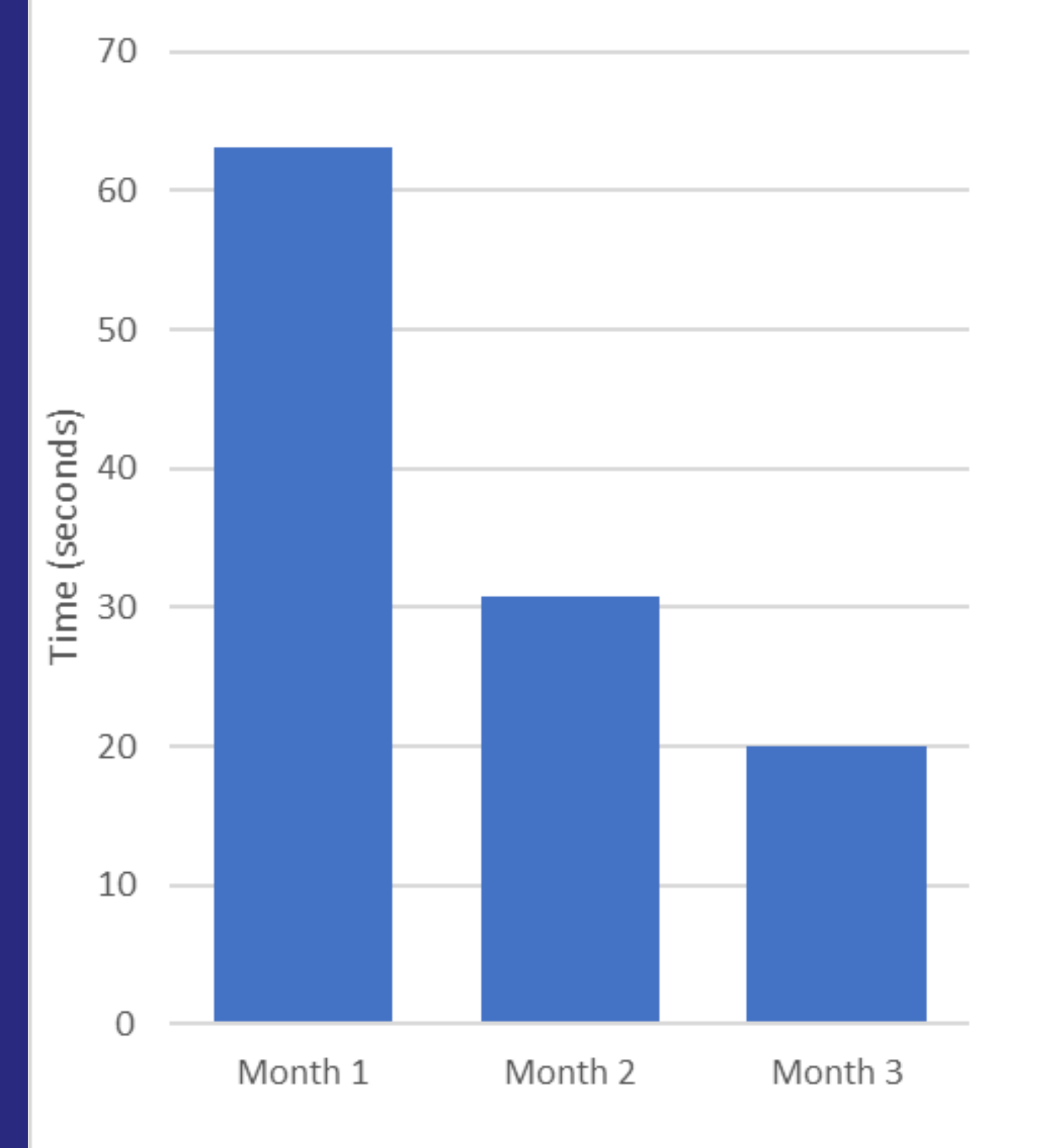
PRIMARY SHIFT WORKED

SHIFT	N (%)
DAY	10 (25%)
NIGHT	5 (12.5%)
ROTATING	25 (62.5%)

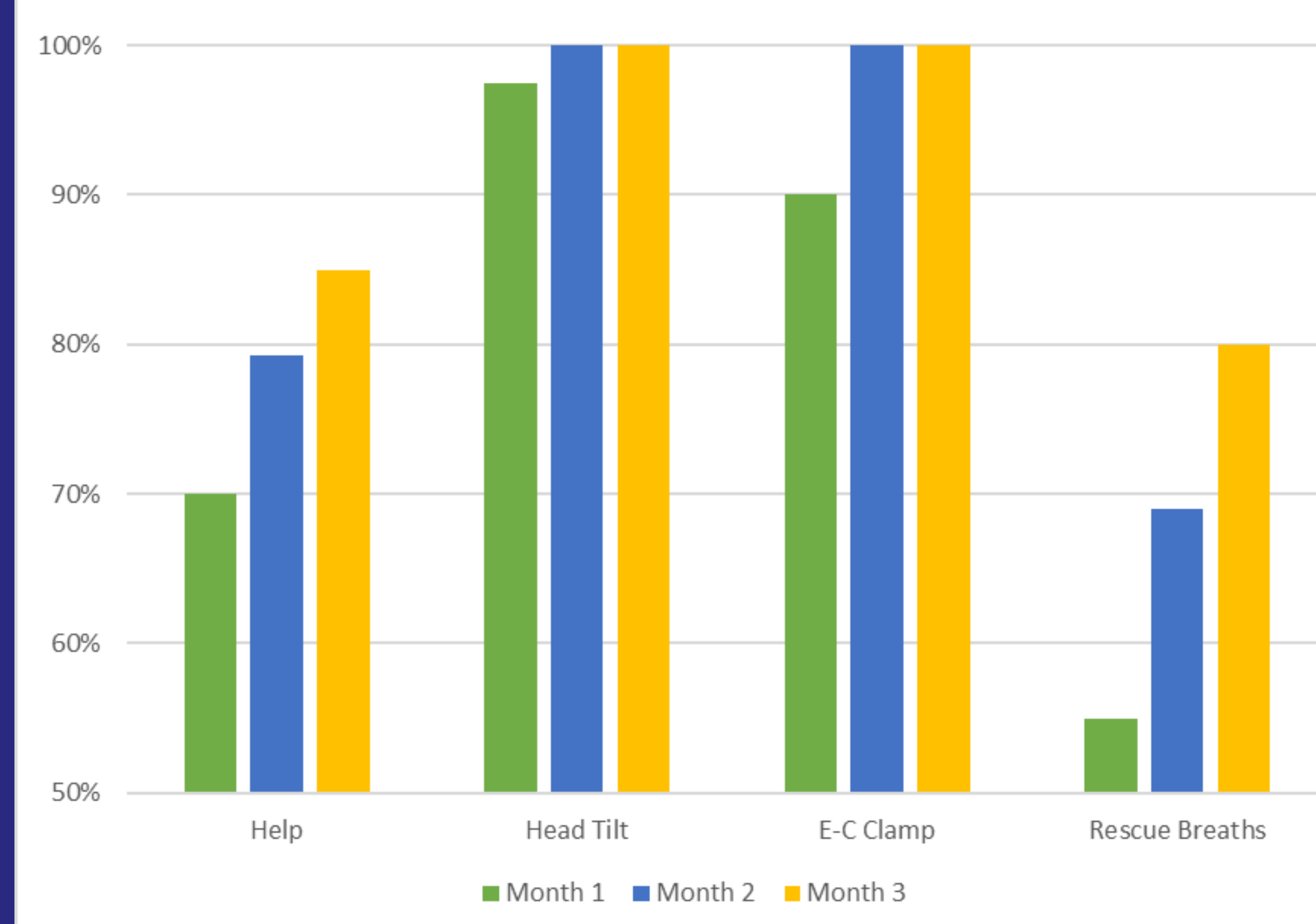
YEARS OF ICU EXPERIENCE

YEARS	N (%)
0-5	25 (62.5%)
6-10	8 (20%)
11-15	3 (7.5%)
16-20	2 (5%)
>20	2 (5%)

AVG TIME TO MANNEQUIN BAGGING



INTERVENTION SUCCESS RATE



ROLLING REFRESHER SCORING QUESTIONS

- Did the participant call for help? Yes/No
- Did the participant perform the head tilt, and chin lift maneuver? Yes/No
- Did the participant grab the bag and begin bagging the patient and ensure equal chest rise with bagging with bag/mask? Time in Seconds:
- Did the participant use the E-C clamp technique to provide an adequate seal? Yes/No
- Did the participant provide rescue breaths at a rate of 1 breath every 2-3 seconds? Yes/No

RESULTS

- 40 RNs (58.8%) participated in the first month's simulation.
- 27 RNs (39.7%) participated in the second month's simulation.
- 20 RNs (29.4%) participated in the third month's simulation.
- In total, 87 rolling refresher simulations were completed.
- Time in Seconds Begin Bagging:
 - Decreased over the three simulation sessions ($F_{(2,52.428)} = 37.495, p < .001$).
- Calling for Help:
 - This behavior was not statistically significant throughout the three simulation sessions ($\chi^2 = 1.80, df = 2, p = .405$).
 - Occurred 70% of the time (n=28) during the first month and 85% (n=17) during the third month.
- Head-Tilt, Chin-Lift:
 - The 95% confidence interval for the performance of this behavior in the first-month simulation session ranged from 86.8% to 99.9% completion.
- E-C Clamp Method:
 - The 95% confidence interval for the performance of this intervention in the first-month training session ranged from 76.33% to 97.2% completion.
- Rescue Breathing at AHA Recommended Rate:
 - Did not significantly increase throughout the three training sessions ($\chi^2 = 4.11, df = 2, p = .128$).

LIMITATIONS

- Malfunctioning mannequin impacted participant's performance and created delays in bagging which affected scoring.
- Pre-intervention data was not available to determine the ultimate effect of intervention on RN's resuscitation performance.
- Aggregate data prevented comparing the participants' performance to years of ICU experience and specific shift, which would inform future planning of specific rolling refresher activities.
- High patient acuity and maximum CICU capacity limited rolling refresher participation during RNs' work shifts.

PRACTICE IMPLICATIONS/FUTURE WORK

- Data suggests rolling refresher simulations have a positive impact on RN performance.
- Improvements in performance prompted further rolling refresher simulation experiences and continued implementation in the CICU.
- Future repeated measures research to determine the relationship between specific RN demographics and retention of knowledge to help inform time and content of refresher activities.
- Longitudinal research to determine the impact on the total number of IHCA due to respiratory decompensation in the CICU.

CONCLUSION

- Implementing frequent rolling refresher in-situ simulation training for CICU nurses appeared to improve adherence to the AHA-recommended pediatric resuscitation interventions and improved time in seconds to recognize and rapidly intervene in these scenarios.
- Exposure to low-frequency, high-risk interventions can aid in preventing respiratory failure and further deterioration in the pediatric CICU population. Recent CICU data for 2023 shows a 22% reduction in cardiac arrests secondary to respiratory failure, suggesting a correlational relationship between rolling refresher simulation and its impact on IHCA.