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Original Research

High-Fidelity Simulation With Debriefing: Best Practice Education for Flight Nurses?

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A B S T R A C T

Objective: High-fidelity simulation with debriefing has been shown to be effective in maintaining high-risk, low-volume proficiencies in nursing. The purpose of this evidence-based practice project was to implement high-fidelity simulation with debriefing to measure improvements in flight nurse skill acuity and retention when performing intubations.

Methods: This was a prospective evidence-based project conducted before and after a debriefing intervention that took place at HealthNet Aeromedical Services, Charleston, WV. Participants were flight nurses who were asked to intubate during a high-fidelity simulation session and participate in a debriefing session to reflect on their performance. They were then tested on 7-month skill retention. Eight subjects completed all stages of the study and were included in the analysis.

Results: The mean ± standard deviation time to successful intubation predebriefing was 26.9 ± 11.9 seconds; for postdebriefing, it was 24.8 ± 5.8 seconds. The mean ± standard deviation checklist score before debriefing was 7.9 ± 0.4 points, whereas for postdebriefing it was 9.4 ± 0.7 points.

Conclusion: The implementation of debriefing after simulation improved the time to intubation and produced better clinical judgment and mastery while performing the intubation.

Flight nursing is a unique subspecialty of nursing requiring an unpredictable work schedule, an uncontrolled environment, limited supplies and work space, advanced high-acuity procedures, and alternative assessment and treatment approaches; it cannot be appropriately likened to any hospital-based critical care area.[1] Only 4.3% of registered nurses are currently employed in the transport environment.[2,3] Despite the small number of flight nurses, the field is rapidly growing. There was a 105% increase in air medical helicopters in the United States from 2003 to 2019.[4] This is caused in part by rural hospital closures, an aging population, ground ambulance staffing challenges, and shorter wait and/or transport times offered by helicopters.[5,6]

The abundance of medical helicopters has led to oversaturation and unnecessary flights because of increased availability. Flight nurses now often care for stable patients with minimal high-acuity interventions who are being flown for convenience, not medical necessity.[7] These nonemergent flights lead to clinician skill fade, which in turn leads to poor clinical and patient outcomes as well as poor job satisfaction and increased burnout and turnover.[7]

Endotracheal intubation is a lifesaving procedure that is a hallmark of a flight nurse's skill repertoire. The skill of intubation is difficult and requires a high level of skill to perform correctly in emergent situations.[8] Because of the high-risk nature of intubation, quality metrics set by the Ground Air Medical Quality Transport database set a 100% first-pass success quality standard for intubations performed by flight nurses.[9] To attain and maintain the required 100% success rate is essential yet challenging. Therefore, flight nurses must be trained in the best, most efficient way for skill acquisition and retention.

Findings from the literature suggest that high-fidelity simulation with debriefing shows increased high-acuity skill attainment and retention in flight nurses compared with standard low/medium-fidelity simulation and didactic education.[10,11] A meta-analysis proved that simulation-based medical education with debriefing was superior to traditional clinical education or a preintervention baseline.[11] This meta-analysis also concluded that traditional, clinical

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education is insufficient if the educational aim is skill attainment and improved patient safety. However, there is little literature directly relating to high-fidelity simulation, specifically in the population of flight nurses.

In the air medical setting, high-fidelity simulations can be defined as having the ability to expose participants close to the actual process of air medical transport. This simulation experience includes electronic communication, a constricted environment, visual and auditory stimuli, and vibration as well as a lack of resources, time constraints, and physiological stressors.[12]

High-fidelity simulation with debriefing affords the learner the potential to develop skills, rationale for best practice, and higher-level critical thinking skills.[13] The purpose of this quality improvement study was to use high-fidelity simulation with debriefing to improve flight nurse skill retention.

Methods

This was a prospective evidence-based project conducted as an initial simulation session with debriefing and a follow-up simulation session 7 months later. This project was identified as nonhuman research by the institutional review board at the University of Tennessee, Knoxville, TN, which was also accepted by the study site at HealthNet Aeromedical Services, Charleston, WV. This project did not receive grant funding from agencies in the public, commercial, or not-for-profit sectors. The project took place during routine staff training at HealthNet Aeromedical Services, which provides not-for-profit critical care transport and is affiliated with Cabell Huntington Hospital, Charleston Area Medical Center, and West Virginia University Medicine. HealthNet Aeromedical Services uses a retired BK-117 helicopter fuselage that has been equipped as a high-fidelity air transport simulator. The simulator is operated by clinical educators that specialize in simulation training and hold master's degrees in adult education.

Flight nurses who receive annual training at HealthNet Aeromedical Services have at least 3 years of in-hospital critical care experience and more than 450 hours of additional training before being cleared for work on the helicopter. First, all flight nurses were invited to participate using an online survey to establish inclusion criteria and willingness to complete the debriefing exercise. Initially, 43 responses to the survey were collected out of 53 available flight nurses, lending to the feasibility of the project. Twelve flight nurses completed the initial simulation session with debriefing, and 4 were lost to follow-up, leaving a total of 8 flight nurses completing both sessions. The sample population is outlined in Figure 1.

All participants were assigned an online didactic course on intubation and airway management before the first in-person simulation competencies. During the project site's annual competencies for flight nurses, these flight nurses participated in a high-fidelity simulation that included the skill of intubation. After the simulation, the debriefing consisted of participants watching a short prefilmed video to guide reflection on the experience. The debriefing video was created by the project leader and was created using Tanner's model of clinical judgment, which includes 4 phases of reflection (ie, noticing, interpreting, responding, and reflecting) and helps nurses develop clinical reasoning using generalized knowledge and rational processes combined with an engaged vision and moral reasoning, encouraging a higher thought process and promoting "nurse thinking."[14] Participants also completed a follow-up simulation session that also included intubation 7 months after the initial session.

All simulation sessions were video recorded, which is HealthNet Aeromedical Services' standard practice for yearly competencies. These video recordings were then reviewed to accurately measure

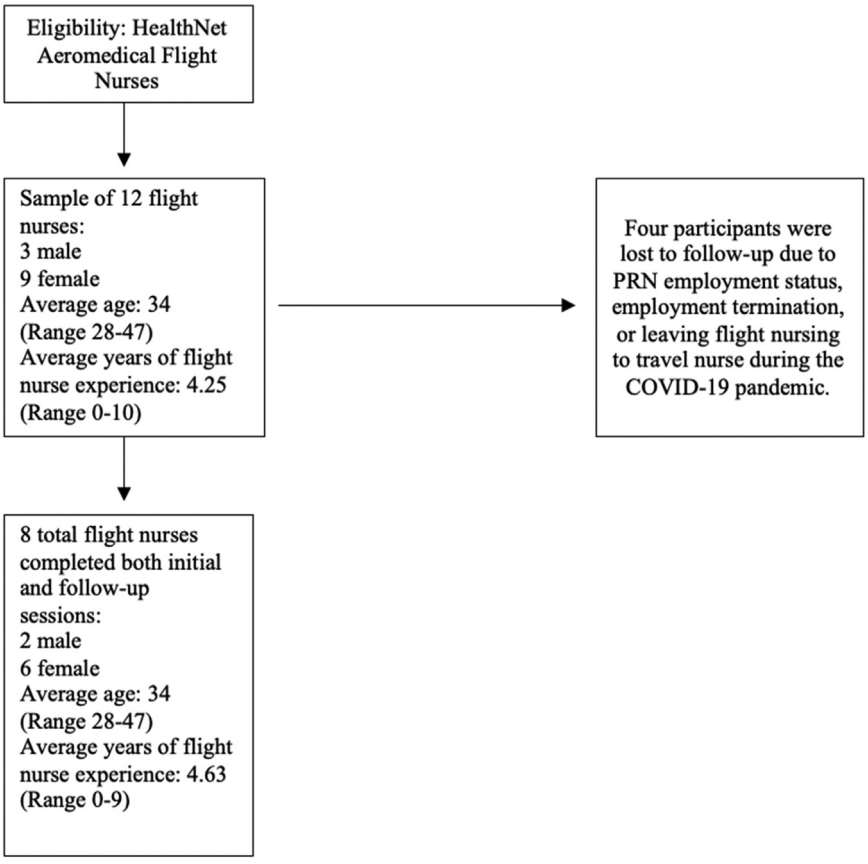

Figure 1. Sample Population. COVID-19, coronavirus disease 2019.

the time to intubation and verify which items were completed on the intubation checklist to create the checklist score. The data collected were the time to successful intubation completion and a checklist score. The time to successful intubation was defined as the time from which the blade of the laryngoscope was in hand with intent to intubate until there was positive endotracheal tube placement confirmed by a numeric or colorimetric end-tidal carbon dioxide indicator. An intubation-specific checklist was created by the project leader and was used to collect data on the completeness of the skill, which includes preparedness for the skill including the ability to verbalize the need for intubation in a patient displaying clinical judgment, knowledge of the equipment needed for intubation, and the ability to perform the skill and verify that it was performed correctly. Multilevel observational checklists that assess nurses during complex decision-making simulation have been proven as reliable assessments of clinical decision making and performance.[15] This checklist is shown in Figure 2 and had a maximum point value of 10. All timing and checklist scores were reviewed by the project leader to limit variability with 25% cross-checked with the project site educator to provide interrater reliability. A consensus was reached between the reviewers for all examined cases.

The primary outcome measures for the project included the intubation time to skill completion, a successful intubation rate, and the retention of intubation skill after high-fidelity simulation with a debriefing session. The initial skill completion time was compared to the follow-up skill completion time using a paired *t*-test to determine statistical significance between the 2 times. A paired *t*-test was also used to determine statistical significance between pre- and postintervention checklist scores. All analysis was completed only for participants who completed both simulation sessions. SPSS version 26 (IBM Corp, Armonk, NY) was used for the analysis.

Results

The mean ± standard deviation (SD) time to successful intubation for all study participants before participating in the debriefing process was 38.8 ± 28.7 seconds. Postdebriefing and at the follow-up

Category	Done Correctly	Done incorrectly or Not Done	Multiple Attempts
	1 point	0 points	-1 point for each attempt
Verbalizes the need for intubation	☐	☐	N/A
Pre-Procedure:			
Prepares Equipment (ETT, BVM, ETCO2, Suction, Blade, etc.)	☐	☐	N/A
Prepares Medication (Sedation, Paralytic)	☐	☐	N/A
Prepares Patient (Positioning, pre-oxygenation, IV access, etc.)	☐	☐	N/A
Vocalizes backup plan/prepares backup device	☐	☐	N/A
Procedure:			
Successful placement of ETT	☐	☐	☐
Balloon Inflation	☐	☐	N/A
Post-Procedure:			
Confirmation of ETT via ETCO2	☐	☐	N/A
Tube securement	☐	☐	N/A
Positive pressure ventilation (BVM or ventilator)	☐	☐	N/A
Total Score: **Max Score is 10**			

Figure 2. Intubation Skills Checklist. BVM, bag valve mask; ETCO2, end-tidal carbon dioxide; ETT, endotracheal tube; IV, intravenous; N/A, not applicable.

Table 1
Descriptive Statistics

	n	Mean	Standard Deviation
Initial timing to successful intubation (s)	8	26.9	11.9
Follow-up timing to successful intubation (s)	8	24.8	5.8
Initial checklist score	8	7.9	0.4
Follow-up checklist score	8	9.4	0.7

Table 2
Mean Differences Between Pre- and Postdebriefing Simulation Sessions

	n	Mean	Standard Deviation	*P* Value
Difference in intubation timing pre- and postdebriefing	8	2.1	15.8	.357
Difference in checklist score pre- and postdebriefing	8	1.5	0.9	.001

session 7 months later, the mean ± SD time was 24.8 ± 5.8 seconds. The mean ± SD checklist score before debriefing was 7.5 ± 1.2 points.

The mean ± SD time for intubation before debriefing (n = 8) was 26.9 ± 11.9 seconds, and the mean ± SD checklist score before debriefing was 7.9 ± 0.4 points. At the follow-up session postdebriefing, the mean ± SD checklist score was 9.4 ± 0.7 points. Descriptive statistics can be found in Table 1.

An overall improvement was noted in the group both in the initial time to intubation and the checklist score. The improvement in timing was noted to be −2.1 ± 15.8 seconds (mean ± SD) with a 95% confidence interval of −11.0 to 15.3 seconds ($P = .357$). The improvement in the checklist score postdebriefing was 1.50 ± 0.9 points and a 95% confidence interval of 0.7 to 2.5 points ($P = .001$). *P* values < .05 were considered to be statistically significant. These results are displayed in Table 2. Participants who were unable to follow up at the second simulation session (missing data) were not included in the final analysis.

Discussion

Flight nurses are expected to perform high-level, high-risk skills such as intubation in uncontrolled environments and at low-frequency intervals.[1] This project aimed to look at whether high-fidelity simulation with debriefing postsimulation would help flight nurses maintain or even improve on skills such as intubation. The improvement in checklist scores was found to be statistically significant, which speaks to improved knowledge, preparedness, and understanding of the skill and all components necessary for successful completion as well as improved clinical judgment and best patient outcomes.

Although an improvement in the timing to successful intubation was noted, the decrease in the time to successful intubation was not statistically significant. However, in an industry where every second counts, any improvement in time should be considered clinically significant. Increased time or multiple attempts taken before successful intubation are associated with increased morbidity caused by events such as oxygen desaturation, aspiration pneumonia, or swelling of soft tissues.[16] Decreased time to successful intubation regardless of statistical significance leads to better patient outcomes.

A literature review proved that it is possible to maintain competency of a skill from 3 months up to 1 year after a high-fidelity simulation session and that individuals may even improve on skills in follow-up sessions postsimulation.[17,18] This project remained consistent with the literature by proving that flight nurses can maintain and improve on skills such as intubation over a period of months, not only in the timing to the completion of the task but also in completing the task in a more technically sound way as evidenced by a statistically significant improvement in the checklist scores. The chance to reflect on performance using the debriefing video may have created a stronger mental connection to the skill of intubation and helped the flight nurses draw on that experience during the second simulation session. Debriefing can not only increase knowledge but also impact future skill performance as evidenced by the results seen from this project.[19]

This project shows that including a debriefing session after simulation sessions can be vital in maintaining and even improving a flight nurse's skill set as well as increasing and improving flight nursing clinical judgment.[19] Debriefing allows participants to reflect on their performance and use self-reflection to perform better postdebriefing. This project highlights areas for potential further study such as the use of debriefing after all simulation sessions for all flight clinicians, not just nurses.

Limitations

As an evidence-based doctor of nursing project, this is not a research study. Caution should be noted in making inferences from the outcomes because of the small sample size. The loss of 4 initial participants to follow-up was unfortunate; however, they were removed completely from the analysis to avoid skewed results. The reasons reported by the participants unable to follow-up at the second simulation session included a change to their as needed status, accepted travel nursing positions, and required overtime with increased pay offered during the coronavirus disease 2019 pandemic. The initial methodology for the project included follow-up and a second high-fidelity simulation session at the 3-month interval. However, because of the forced shutdown of in-person educational programs secondary to high community rates and exposure risk for COVID-19 in the West Virginia area, the 3-month timeline was altered to 7 months by the supporting hospitals of HealthNet Aeromedical. Although the timeline was adjusted from the initial protocol, the 7-month follow-up was supported by the literature.[11,17] It also lends more credibility to the project because skills and timing were improved on over a longer period of time.

Participants were also more likely to know that they were being analyzed on intubation at the follow-up simulation, which could have benefitted the improvement in the time to intubation. Participants were not privy to the checklist at any time during the project and were not aware of the criteria being assessed. It also must be noted that despite excellent training facilities and equipment, a training simulation cannot and does not replicate the stressors and environment of intubating in the prehospital setting. Additionally, there were individual factors that could not be controlled for including ages, years of clinical and flight nursing experience, number of recent intubations in the field, and educational backgrounds. Because of the small sample size, these factors could not be accounted for. A larger sample size in future studies could enhance and solidify the findings from this study.

Conclusion

Flight nurses provide superior emergency care and are asked to perform advanced, lifesaving skills in an unstructured and limited-support environment.[1] Flight nurses must be trained appropriately to be able to respond and function at a high level, especially when executing low-volume/high-acuity skills. High-fidelity simulation with debriefing is an educational learning format that assists in teaching and retaining critical skills, specifically intubation, in currently practicing flight nurses. The recommendation for the use of high-fidelity simulation with debriefing to train flight nurses is supported by research and is congruent with the findings of this project. This

project shows that implementing debriefing after simulation sessions improves flight nursing knowledge of and preparedness for intubation, which can lead to better flight nursing skill, clinical judgment, and ultimately lead to improved patient outcomes. Further study is needed to investigate high-fidelity simulation with debriefing in other flight providers and with other high-acuity skills.

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