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General Anesthetic Induction Sequence High Fidelity Simulation: Determining Efficacy Among Novice Student Registered Nurse Anesthetists

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Background

High Fidelity Simulation (HFS) is used across multiple health professions. Despite the wide variety of clinical experiences that Student Registered Nurse Anesthetists (SRNA) possess prior to training, the induction sequence to a General Anesthetic (GA) is a daunting task. Although the efficacy of HFS has been widely studied within undergraduate nursing programs, there are no studies published determining the efficacy of HFS on SRNA training.

The purpose of this study was to determine the efficacy of simulation training amongst entry-level SRNA's and examine any individual participant factors that may influence clinical performance within HFS.

Methods

- Human subjects were protected (Spokane IRB ID: STUDY18000465)
- Pilot study participants recruited from 1st semester SRNAs in the Doctorate of Nurse Anesthesia Practice (DNAP)
- Full study participants recruited from prospective DNAP students
- Primary endpoints: efficacy of GA induction sequence HFS
- Secondary endpoints: individual participant factors that may influence clinical performance within HFS
- Scoring tool developed to measure primary outcome (Figure 2)
- PowerPoint and didactic lecture provided to all participants
- Pretest assessment following didactic training, using scoring tool, prior to HFS
- Participants guided through HFS and subsequently debriefed
- Posttest assessment completed following HFS using scoring tool
- Each participant allotted 60 minutes for individual HFS session
- Analysis of variance utilizing a waitlisted study design
- A priori confidence level ($\alpha < 0.05$)

Findings

Table 1. Demographic and Clinical Characteristics (N=37)

Characteristic	Count	Percent
Gender Male	12	32%
Gender Female	25	68%
Type of Critical Care Experience		
CVICU	13	35%
MICU	8	22%
NICU	3	8%
SICU	3	8%
Mixed	10	27%
Age		
< 30	18	49%
≥ 30	19	51%
RN Experience (years)		
1 up to 3	8	22%
3 up to 7	23	62%
> 7	6	16%
Critical Care Experience (years)		
1 up to 3	18	49%
3 up to 5	12	32%
> 5	7	19%
First semester SRNA	11	30%
Prospective SRNA	26	70%

CVICU = Cardiovascular Intensive Care Unit, MICU = Medical Intensive Care Unit, NICU = Neurosurgical Intensive Care Unit, SICU = Surgical Intensive Care Unit, Mixed = Mixed Intensive Care Unit, ICU = Intensive Care Unit, RN = Registered Nurse, SRNA = Student Registered Nurse Anesthetist

Figure 1. Power Analysis based on Pilot Study

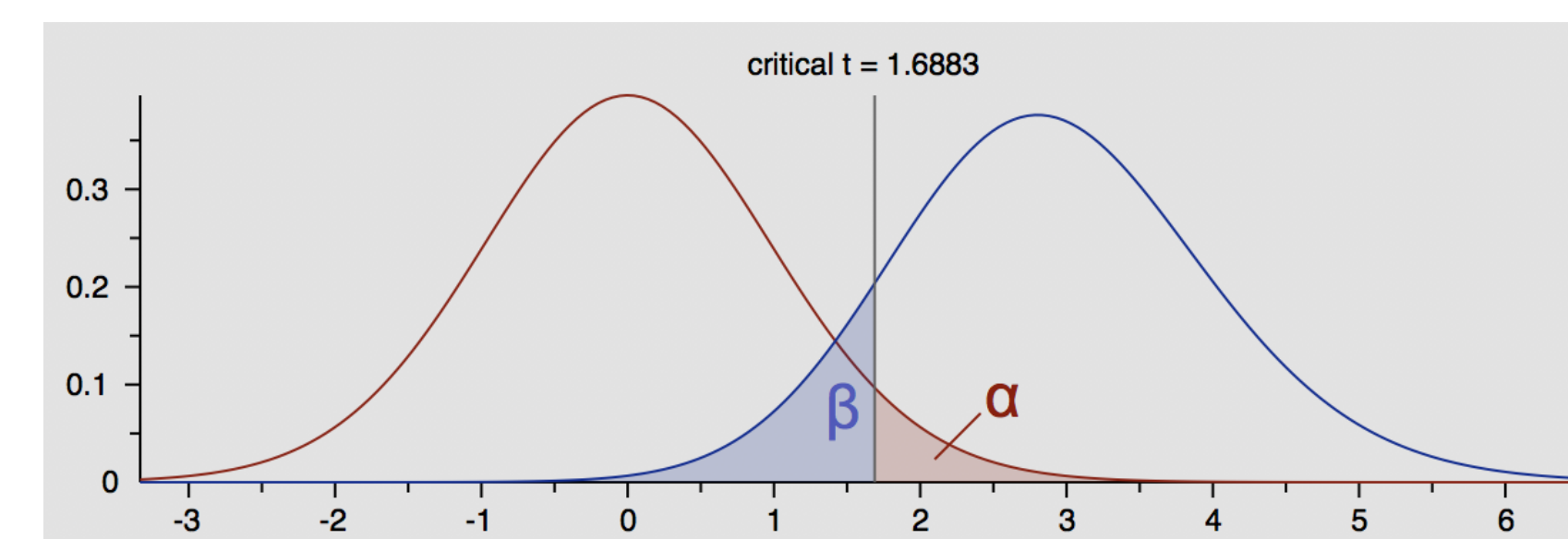


Table 2. Efficacy of High-Fidelity Simulation (N=37)

	Mean Pre HFS Score	Mean Post HFS Score	Mean Δ HFS Score	95%CI	p-value
HFS	23.7	33.4	+9.7	8.0-10.7	< 0.001

HFS = High Fidelity Simulation

Findings (cont.)

Table 3. Change in HFS Scores by Demographic and Clinical Characteristics

Demographic and Clinical Characteristics	n	Percent Δ HFS Score	Mean Pre HFS Score	Mean Post HFS Score	Mean Δ HFS Score	95% CI	p-value
Type of Critical Care Unit							
CVICU	13	25%	24.8	33.0	8.2	6.2-9.7	<0.001
MICU	8	31%	23.3	33.8	10.5	8.4-13.5	<0.001
NICU	3	29%	23.8	33.2	9.4	7.7-12.2	<0.001
SICU	3	29%	23.3	33.3	10.0	7.2-12.2	<0.001
Mixed	10	28%	23.8	33.2	9.4	6.9-11.0	<0.001
Critical Care RN Experience (years)							
1 up to 3	16	31%	23.0	33.4	10.4	7.5-13.3	<0.001
3 up to 5	13	25%	25.0	33.3	8.3	5.4-11.1	<0.001
>5	9	27%	24.3	33.1	8.8	5.2-12.2	<0.001
Total RN Experience (years)							
1 up to 3	8	29%	23.5	33.1	9.6	6.0-13.2	<0.001
3 up to 5	11	27%	24.8	33.8	9.0	5.7-12.2	<0.001
5 up to 7	12	26%	24.5	33.2	8.7	5.5-11.9	<0.001
>7	6	27%	22.3	32.8	10.5	4.1-13.5	<0.001
Participant Type							
SRNA	11	26%	24.6	33.4	8.8	5.6-11.9	<0.001
PSRNA	27	28%	23.8	33.2	9.4	7.3-11.5	<0.001
Participant Age							
<30	18	27%	24.2	33.2	9.0	6.9-11.0	<0.001
≥30	19	29%	23.8	33.4	9.6	-2.1-2.0	<0.001
Gender							
Male	12	27%	24.0	33.0	9.0	6.9-11.0	<0.001
Female	25	29%	24.0	33.4	10.0	7.9-12.1	<0.001

HFS = High Fidelity Simulation, RN = Registered Nurse, CVICU = Cardiovascular Intensive Care Unit, MICU = Medical Intensive Care Unit, NICU = Neurosurgical Intensive Care Unit, SICU = Surgical Intensive Care Unit, Mixed = Mixed Intensive Care Unit, SRNA = Student Registered Nurse Anesthetist (1st semester), PRNAI = Prospective Student Registered Nurse Anesthetist

Figure 2. Simulation Scoring Tool

Pre-Simulation Assessment Tasks	Performed	Order	Post-Simulation Assessment Tasks	Performed	Order
Equipment Pre check (Suction)			Equipment Pre check (Suction)		
Patient Position (Ramp)			Patient Position (Ramp)		
Apply monitors			Apply monitors		
Obtain baseline Vitals			Obtain baseline Vitals		
Print baseline strip			Print baseline strip		
Preoxygenate			Preoxygenate		
Admin Narc			Admin Narc		
Admin Lidocaine			Admin Lidocaine		
Admin Propofol			Admin Propofol		
Lid reflex			Lid reflex		
Tape Eyes			Tape Eyes		
Mask Ventilate			Mask Ventilate		
Admin Paralytic			Admin Paralytic		
Mask Ventilate			Mask Ventilate		
Intubation			Intubation		
confirm placement			confirm placement		
Gas			Gas		
Vent			Vent		
Flow			Flow		
Tape tube			Tape tube		
Total Score:		/35	Total Score:		/35
Total RN years			previous intubation experience		
How many years of ICU			if so what		
type of ICU					
age (<30, ≥30)					
sex					

Discussion

Our sufficiently powered study detected a 29.0% (mean pre-test 23.7, mean post-test 33.4) improvement in Simulation Assessment Tool scores following HFS ($p < 0.001$). Despite variations in pre HFS scores, post HFS scores remain homogeneous across all participants confirming the effectiveness of our training. Our study also indicated that there were no statistically significant group differences in HFS pre-test scores amongst the participants for the demographic factors we assessed; type of ICU ($p=0.76$), years of ICU experience ($p=0.36$), and age ($p=0.91$).

GA induction sequence training using HFS was proven to be effective among novice SRNA's. In alignment with the current research evidence, the use of HFS among SRNA's may help to improve learning, self-efficacy, and subsequently patient safety. Doctoral nurse anesthesia programs should consider the integration of HFS throughout program curriculum.

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