Saving Maternal Lives through Pre-Simulation Preparation Focused on Interruption Management and High-Risk Content

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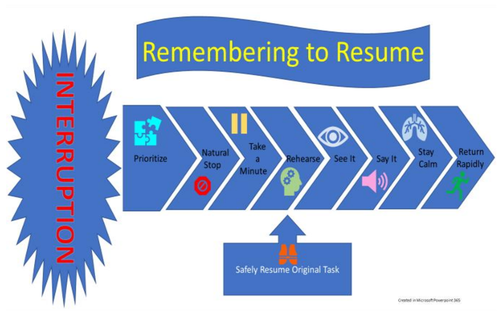
Background

- U.S. maternal mortality rose from 20.1 (2019) to 32.9 deaths per 100,000 live births (2021); ~80% are preventable
- Economic burden grew 30%: $7.9B (2018) → $10.4B (2020)
- Nursing interruptions occur up to 12.7 times/hour; 51.4% of maternal nurses report missed care (247 U.S. L&D units)
- Interruptions contribute to missed interventions and clinical errors
- **Simulation & Interruptions**
- Simulation-based education (SBE) builds interruption management skills
- Pre-simulation activities improve learner readiness and engagement
- **Cognitive Load Impact**
- High workload and multitasking increase cognitive load
- **Experienced nurses:** develop strategies to manage interruptions
- **Novices:** need more time, are more easily overwhelmed, and prone to missing cues or making errors
- **Nested interruptions** (>1 per task): increase error risk by >45x



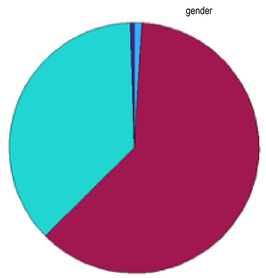
Research Questions

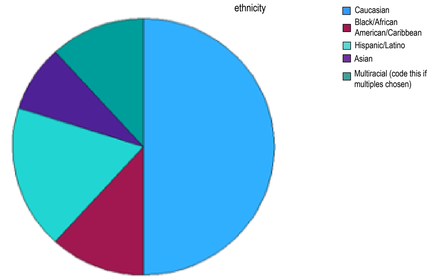
1. *What is the difference between groups receiving varying levels of pre-training on task completion time?*
2. *What is the difference between groups receiving varying levels of pre-training on cognitive load?*

Methods

- **Design:** Between-subjects Pre-Post/Test with 3 groups:
  - **Control:** No pre-simulation training.
  - **Intervention 1:** Pre-eclampsia vSim + Interruption Management training.
  - **Intervention 2:** Intervention 1 + "Last Minute Learning" reflection.
- **Tools Used:**
  - SIMOT: Tracks interruption management strategies.
  - NASA-TLX: Measures cognitive load across six domains.
- **Measures:** clinical actions, timing, SBAR use, cognitive load (NASA-TLX), and perception (SET-M)

- **Population**
  - Pre-licensure students, BSN program, ages 18-43, traditional and accelerated programs, three campuses, 36.9% male
  - 49.5% Caucasian, 18% Hispanic/Latino, 11.7% Black, 11.7% multiracial, 8.3% Asian





Results

Kruskal-Wallis H for Mg Time and Call Time

Active Participants Group Designation	Administered MG Y/N	Average MG administration time	Kruskal-Wallis H for Mg Time	Percent group communicated with provider	Average call minute within 16 minute scenario	Kruskal-Wallis H for Call Time
Control (n=24)	66%	(n=16/24) μ=10 min	H=5.251, df=2, p=.072	37.5%	μ=7.77 (SD:1.72) Range: 6-10	H=6.18, df=2, p=.046
Intervention 1 (n=24)	79%	(n=19/24) μ=11.6 min		79%	μ=10.5 (SD-3.81) Range:6-16	
Intervention 2 (n=20)	100%	(n=20/20) μ= 9.3		80%	μ=10 (SD-3.10) Range 3-13	

Control: No pre-simulation training. ***Intervention 1:*** Pre-training included preeclampsia vSim plus Interruption Management training. ***Intervention 2***: Same pre-training as Intervention 1 plus 'Last Minute Learning' reflection assignment on simulation day.

Perception of Simulation

SET-M	Response by group (valid)	Average Score (Standard Deviation)
Total SET-M	All: n=192 (93.2%)	μ= 47.05 (6.34)
	Control n=63, 94%	μ= 45.21 (6.81)
	Intervention 1 n= 75, 93.7%	μ=47.61 (6.10)
	Intervention 2 n=54, 93.1%	μ=48.40 (5.72)
Domain 1 pre-briefing	All: n=193 (93.7%)	μ=4.22 (1.53)
	Control n=63, 94%	μ= 3.11 (1.74)
	Intervention 1 n= 75, 93.7%	μ= 4.85 (.97)
	Intervention 2 n=54, 93.1%	μ= 4.59 (1.17)
Domain 2 learning	All: n=193 (93.7%)	μ= 14.42 (2.48)
	Control n=63, 94%	μ= 14.30 (2.53)
	Intervention 1 n= 75, 93.7%	μ= 14.31 (2.62)
	Intervention 2 n=54, 93.1%	μ= 14.72 (2.28)
Domain 3 confidence	All: n=193 (93.7%)	μ= 14.77 (2.54)
	Control n=63, 94%	μ= 14.22 (2.88)
	Intervention 1 n= 75, 93.7%	μ= 14.77 (2.33)
	Intervention 2 n=54, 93.1%	μ= 15.41 (2.29)
Domain 4 debriefing	All: n=192 (93.2%)	μ= 13.64 (1.99)
	Control n=63, 94%	μ= 13.57 (2.09)
	Intervention 1 n= 75, 93.7%	μ= 13.68 (1.85)
	Intervention 2 n=53, 91.4%	μ= 13.62 (2.10)

Group Comparison of total SET-M (perception of Simulation-based education)		
Group	Average total score (standard deviation)	ANOVA
Control	45.32 (6.71)	F(2,195)= 4.99, p=0.008
Intervention 1	47.67 (5.90)	
Intervention 2 (full)	48.73 (5.70)	

Post-Simulation Cognitive Load

Group	N =	Mean post-simulation Cognitive Load (NASA-TLX weighted)
Control (no pre-training)	62	μ=60.78, SD=20.50
Intervention 1 vSim pre-training and Interruption Management	79	μ=61.56, SD=20.67
Intervention 2 vSim pre-training plus interruption management AND Last Minute Learning	56	μ=66.26, SD=16.94

ANCOVA—Weighted scores. Total possible out of 100.
No significance between groups for cognitive load (p=.34)

Discussion

Participants who received the most comprehensive pre-training:

- Delivered patient care more consistently (100%) and efficiently, even during frequent interruptions
- More frequently notified the provider, typically after care was completed (vs. controls who called for direction)
- Most common interruption management strategies: self-advocacy and teamwork
- Despite higher cognitive load, the fully trained group:
- Rated the simulation experience significantly more positively
- Demonstrated engagement without overload—suggesting optimal cognitive challenge

Conclusion: Purposeful, layered pre-training equips learners with essential problem-solving tools to manage complex, interruption-filled scenarios effectively.

Future Recommendations

- ***Education***
  - Integrate segmented, pre-simulation training to support learning and retention
  - Scaffold interruption management skill development across the curriculum using applied simulation
- ***Research***
  - Pursue Kirkpatrick's Level 3 & 4 outcomes:
    - *Level 3:* Assess how training influences RNs' confidence and perceived role in managing interruptions
    - *Level 4:* Observe real-world use of strategies and their impact on cognitive load and patient outcomes

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References