

Implementation of a Simulation-Based Training Session to Improve Malignant Hyperthermia Crisis Management for the Certified Registered Nurse Anesthetist

Clinical Problem

- Malignant Hyperthermia (MH), a complex genetic disorder of skeletal muscle manifests as a hypermetabolic crisis when susceptible individuals receive a halogenated inhalational anesthetic agent or the depolarizing muscle relaxant, succinylcholine
- Affects 1:400 to 1:3,000, incidence 1:10,000 to 1:250,000 occurs most often in children & young adults and more frequently in males than females (2:1)
- The AANA and MHAUS support Malignant Hyperthermia (MH) crisis team training as part of ongoing and annual competency education to prepare anesthetists to recognize, respond to, and treat an MH crisis
- Currently CRNAs at the Children's Hospital of Philadelphia (CHOP) do not receive ongoing annual competency education for MH crisis as recommended by the AANA and MHAUS

Purpose

- Improve knowledge and skill competency of CRNAs related to MH crisis in the operating room setting through simulation-based training

Objective

- Implementation of an annual simulation-based training to improve knowledge and skill competency related to the MH crisis for CRNAs in the operating room setting

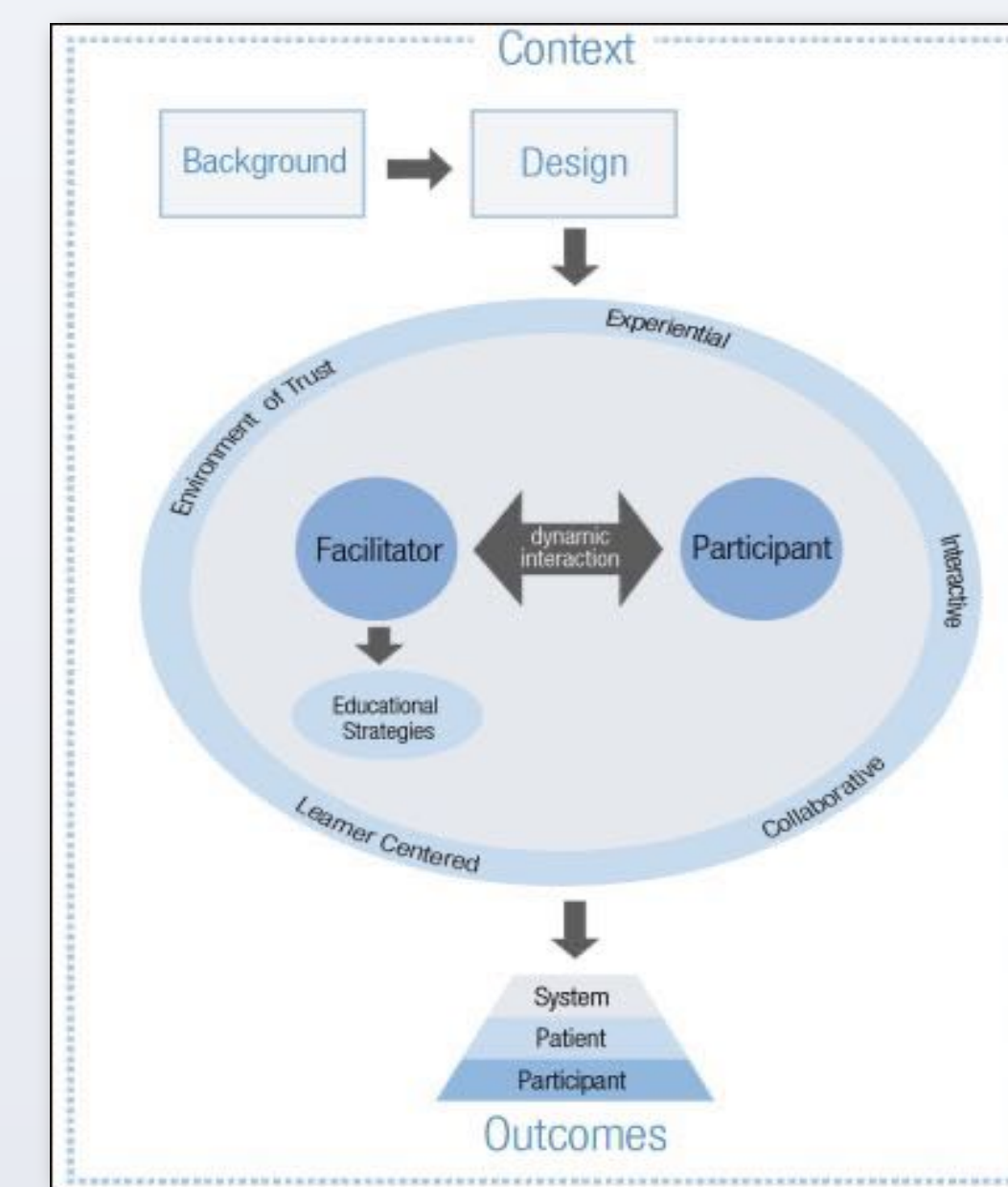
Literature Review

- Ambardekar, et al. (2019) • Simulation-based curriculum enhanced learning in anesthesiology residents
- Lorello, et al. (2014) • Simulation-based training in anesthesiology appears to be more effective than no intervention & non-inferior to non-simulation instruction
- Meja, et al. (2018) • Simulation-based training w/MH high-fidelity scenario was superior to computer-based case study, improving knowledge & skills in MH crisis management
- Cain, et al., (2014) • Simulation-based training improved knowledge & self-confidence to manage MH crisis, clarified roles, improved anticipatory response & overall team cohesion
- Parsons, et al., (2019)

Theory

National League for Nursing (NLN) Jeffries Simulation Theory

- Facilitates best practices for teaching-learning process with simulation
- Presents models for evaluating reliability & validity under varied circumstances in academic & clinical settings



Measures

Knowledge Instrument

- 10 multiple choice questions
- Pre-test/post-test & follow-up two-month post-test

Competency Instruments

- Key Action Checklist: Evaluates technical skills
 - 10 action items or clinical interventions scoring competency
- Anesthetists' Non-technical Skills (ANTS) tool:
 - Evaluates behavior aspects of performance

Intervention

- Review of Pedi Crisis Critical Events MH algorithm
- MH simulation sessions
 - Focus on early identification & intervention

Implementation

- Recruitment of subjects via email
- Pre-simulation knowledge test
- Review of Pedi Crisis Critical Events MH algorithm
- First simulation
- Post-simulation knowledge test
- Second simulation 2 months after initial simulation
- Post-simulation knowledge test

Evaluation

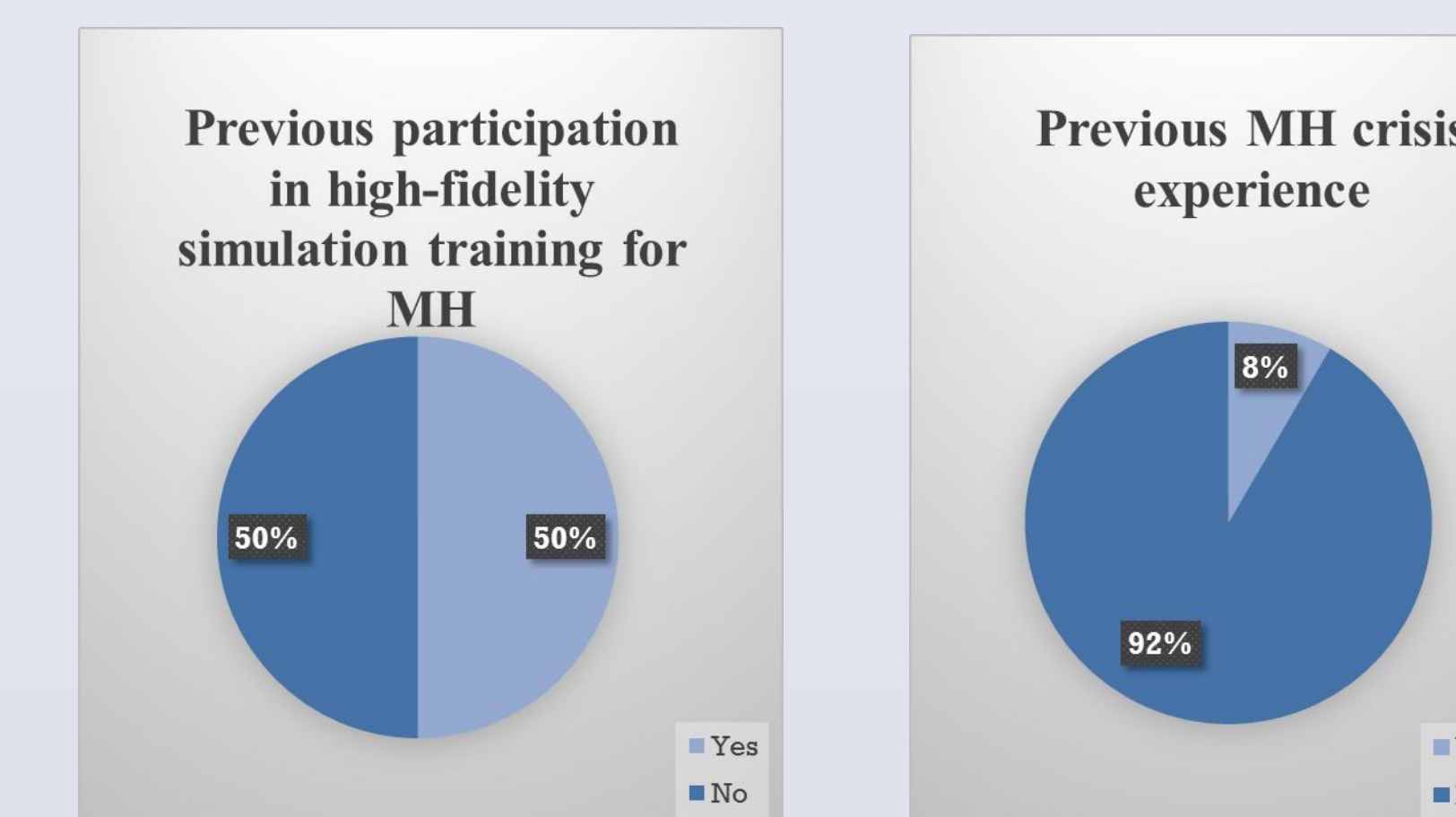
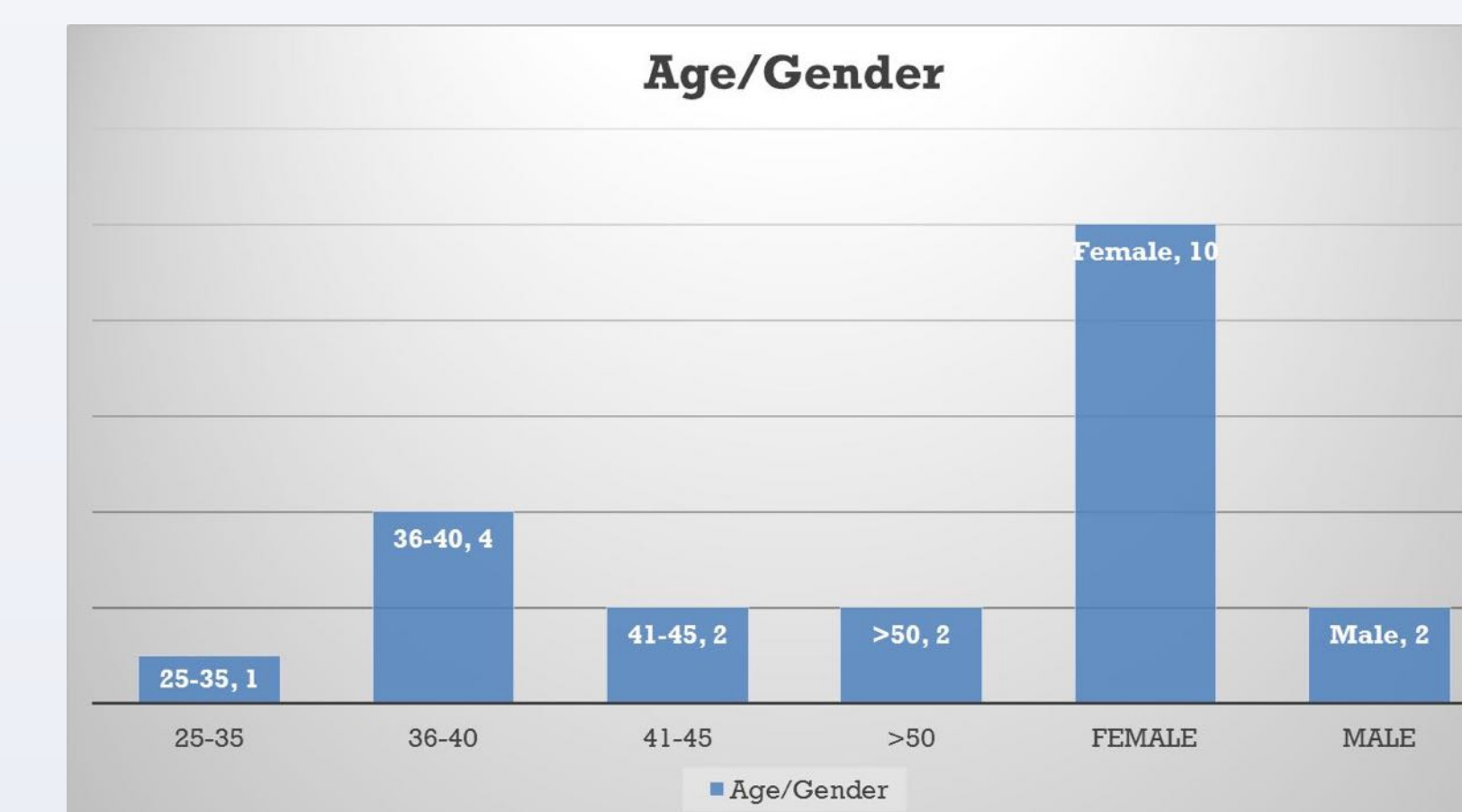


Table 1: Knowledge Test Scores

Knowledge Tests	N	(Pre) Median (IQR)	(Post-1) Median (IQR)	(Post-2) Median (IQR)	Median change (IQR)	P value
Comparison 1	11	8 (8, 9)	10 (9, 10)		2 (1, 1)	0.021
Comparison 2	11	8 (8, 9)		9 (9, 10)	1 (1, 1)	0.013
Comparison 3	11		10 (9, 10)	9 (9, 10)	-1(0,0)	0.66

Table 2: MH Key Action Checklist Competency Scores

Team	N	1 st Simulation	2 nd Simulation	% Improvement
1	4	3.41	4	17%
2	4	3.76	3.82	2%
3	3	3.49	4	15%

Table 3: ANTS Tool Competency Scores

Team	N	1 st Simulation	2 nd Simulation	% Improvement
1	4	7	7.5	7%
2	4	5.5	8	45%
3	3	7	8	14%

Discussion

- Results reinforced that MH simulation at regular intervals can be an effective way to improve and maintain MH knowledge and clinical management of a crisis
- CRNAs embraced and used techniques to improve clinical competency related to MH crisis management

Significance to Nursing Practice

- MH simulation sessions enhance the CRNAs' management of a crisis and are a reasonable addition to continuing education curricula
- Simulation sessions occurring at regular intervals for CRNAs can improve and maintains clinical competency

Conclusion and Future Considerations

- MH simulation-based training at regular intervals can improve technical and non-technical skills contributing to best practice guidelines during MH crisis
- Simulation-based training supports identification of knowledge gaps and improves competency skills for MH crisis management
- Develop simulation-based training curriculum as part of CRNA clinical onboarding and competency maintenance
- Develop interdisciplinary simulation-based training sessions
- Repeat project with larger sample size to increase generalizability of results

Contact Information

Jennifer Raynor
jenraynor@gmail.com

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References available upon request