Cricothyrotomy Simulation Training: Advancing Operational Readiness in Military Nurse Anesthesiology Students

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Disclosures/Funding Information

- The opinions and assertions expressed herein are those of the author and do not reflect the official policy or position of the Uniformed Services University of the Health Sciences (USUHS), the Department of War (DOW), or the TriService Nursing Research Program (TSNRP).
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- This research protocol was reviewed and approved by the USUHS institutional review board (IRB).
- This project was sponsored by the TSNRP (Award HU00012520051), USUHS.

Learning Objectives

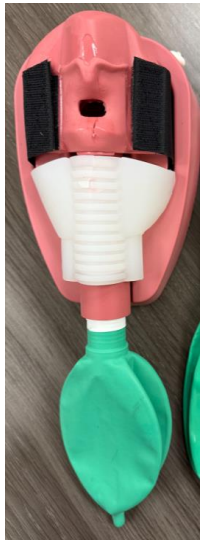
1. Evaluate task trainers and 3-D printed training models for differences in anatomical accuracy, realism, cost, and utility for cricothyrotomy simulation.
2. Analyze this project's cricothyrotomy outcomes including success rates, procedural time, confidence and realism ratings, and learner preference, to determine comparative effectiveness of the task trainer and 3-D printed training model.
3. Propose evidence-based directions for future simulation research and the development of improved cricothyrotomy training models based on this project's findings.

Background

- Tactical Combat Casualty Care (TCCC) Guidelines[1]
  - Cricothyrotomy = Definitive airway management
- Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF):
  - #2 cause of preventable battlefield death: Airway obstruction[2]
  - 33% of prehospital cricothyrotomies failed[3]
    - Secondary source of preventable mortality

Background

- Simulation-based training necessary for cricothyrotomy skills attainment and sustainment[4,5]
  - Task trainers:
    - Low-fidelity
    - Cost-effective
    - Lack realism[5,6]
  - Three-dimensional (3-D) printed models:
    - Moderate-fidelity
    - Affordable
    - Enhanced realism[7]



Task Trainer

3-D Model

Aim

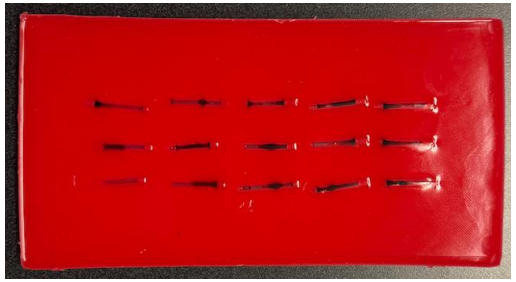
To compare a task trainer (TT) and a 3-D printed model (3-DM) for cricothyrotomy training in first-year nurse anesthesiology students using the scalpel-bougie technique and determine which training model was associated with better success rates, faster procedural performance, higher student confidence, and which training model the students felt was the most realistic and the more preferred model

Methods

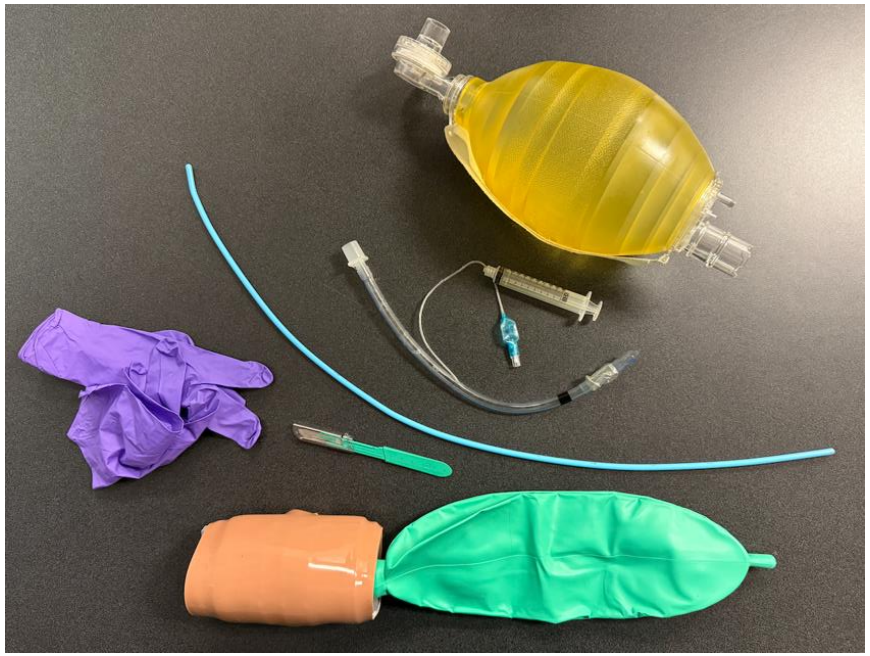
Task Trainer (TT)

3-D model (3-DM)

"Bleeding" tissue layer

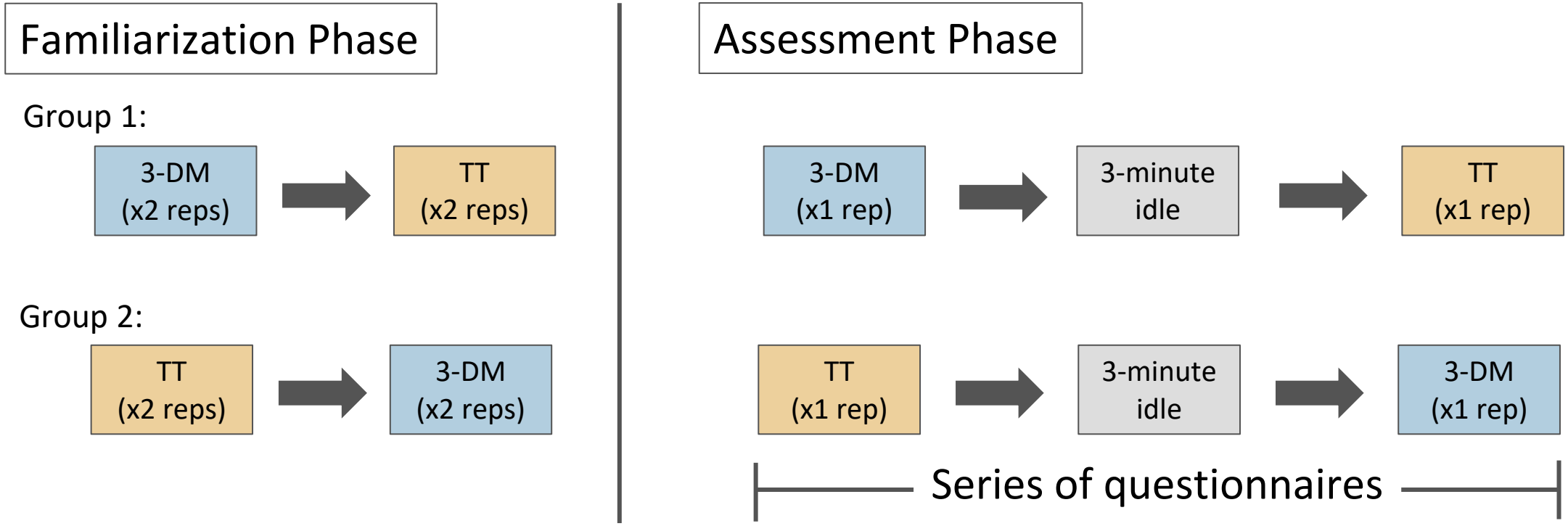


Final Appearance of 3-D Model & Supplies



Methods

Within- and between-subjects design



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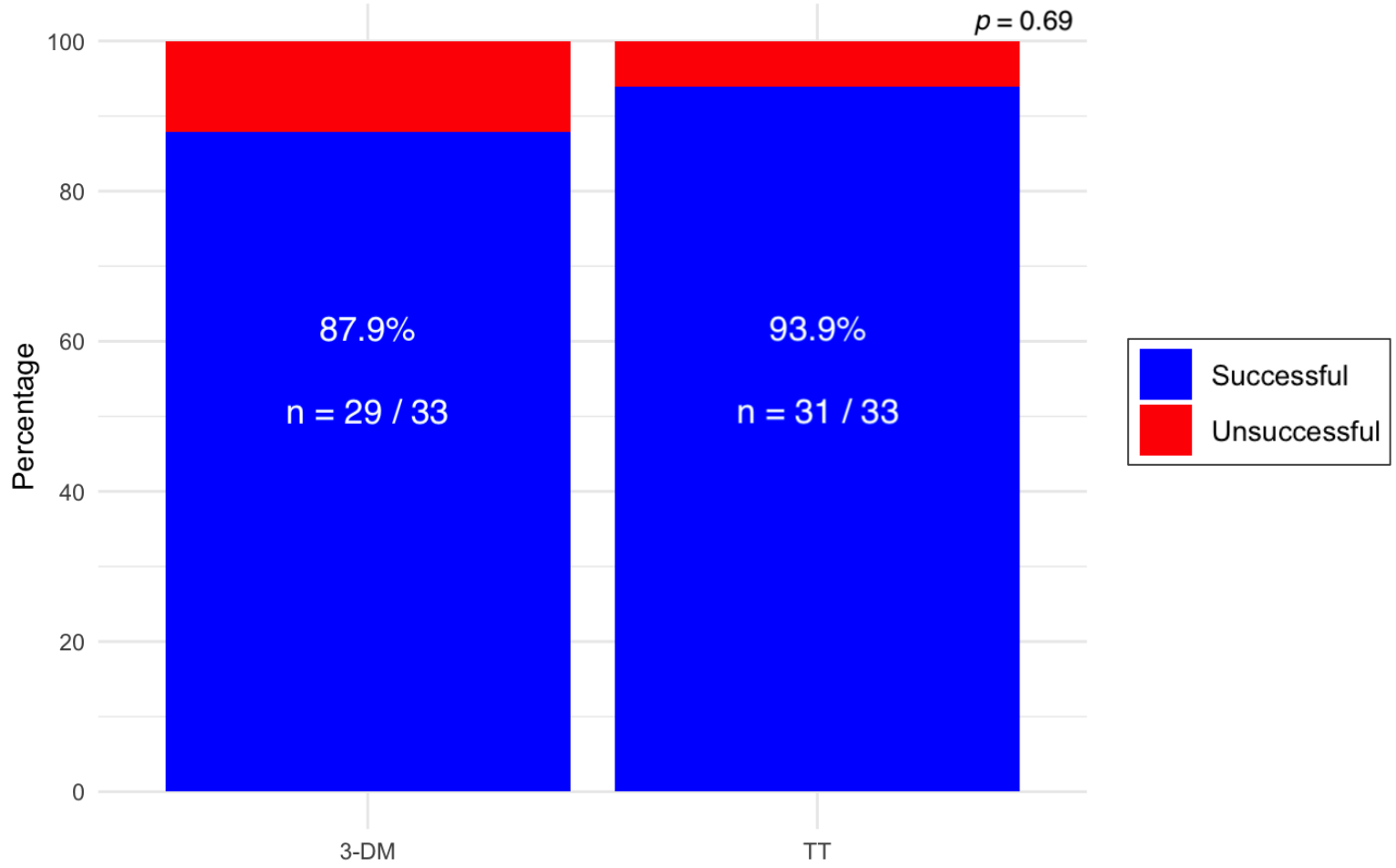
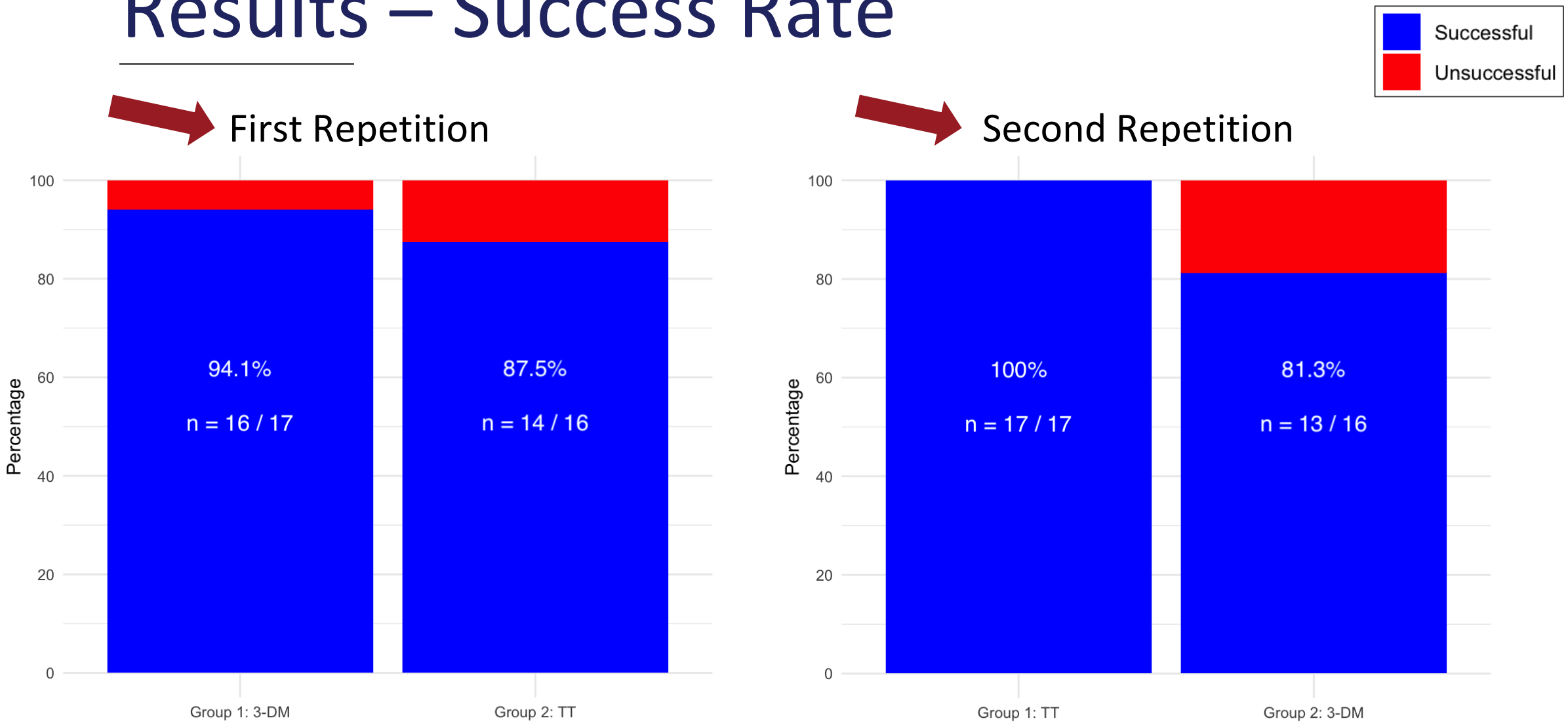
Results – Demographic Data

- n = 33 students
  - Group 1: n = 17
  - Group 2: n = 16
- 25-34 years old (n = 20, 60.6%)
- Female (n = 21, 63.6%)
- White (n = 26, 78.8%)
- Not Hispanic or Latino (n = 28, 84.8%)
- More than 12 months since last cricothyrotomy training (n =17, 51.5%)
- Prior experience with live tissue cricothyrotomy (n =10, 30.3%)
  - Number of live tissue repetitions: 1 or 2 (n = 8, 80%)
  - Most common technique for live tissue repetition: Open surgical (n =7, 70%)

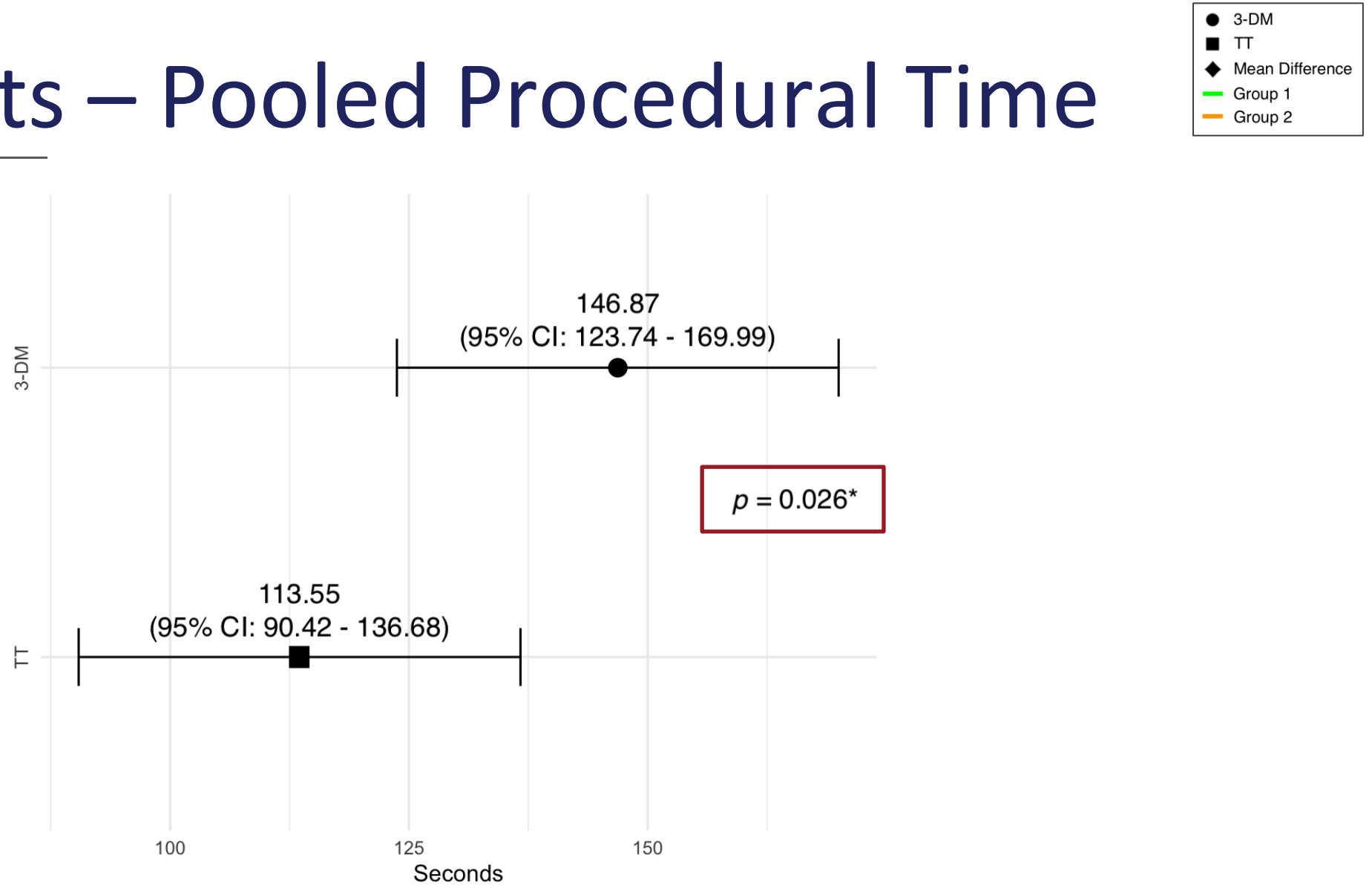
Results – Pooled Success Rate



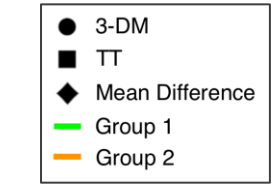
Results – Success Rate



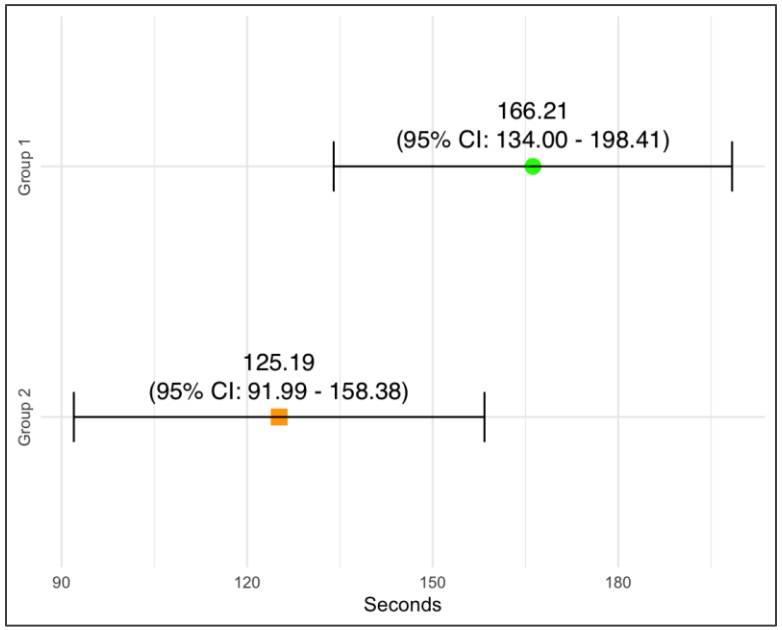
Results – Pooled Procedural Time



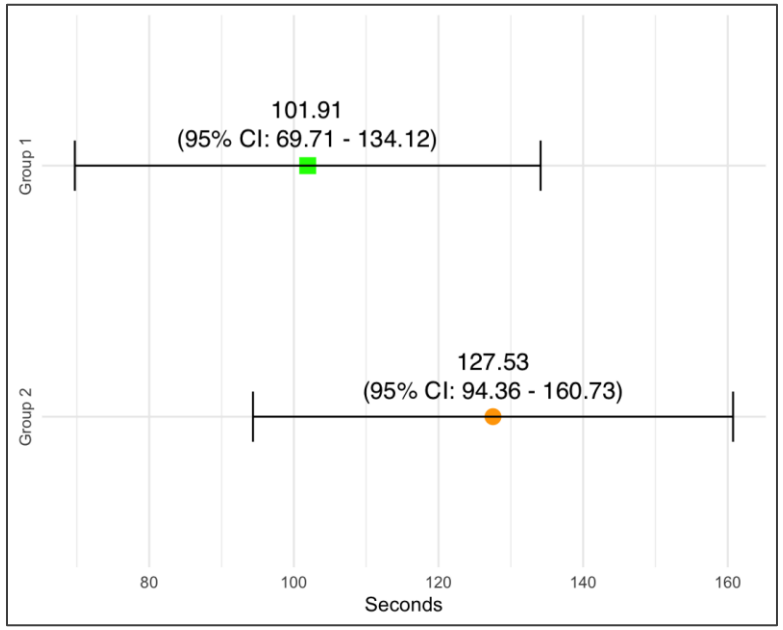
Results – Procedural Time



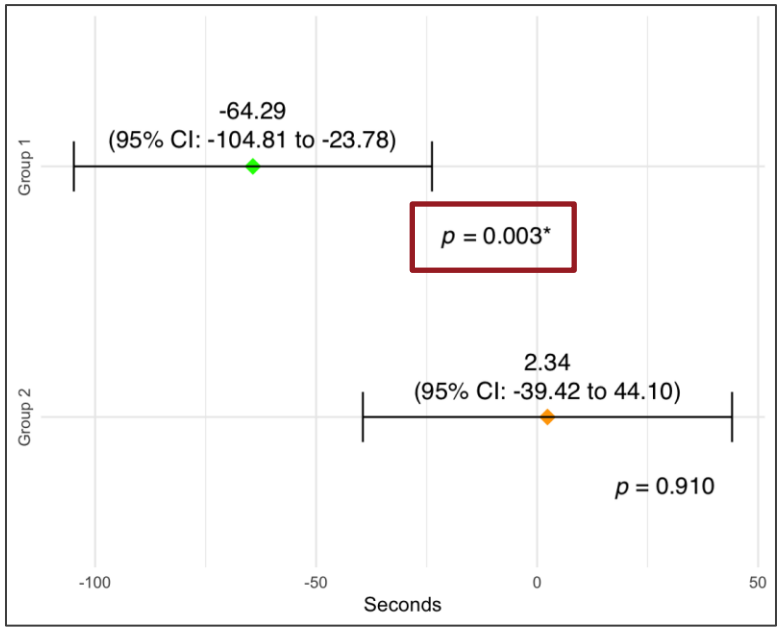
First Repetition



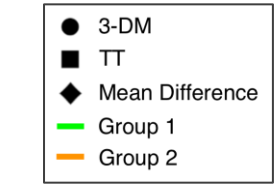
Second Repetition



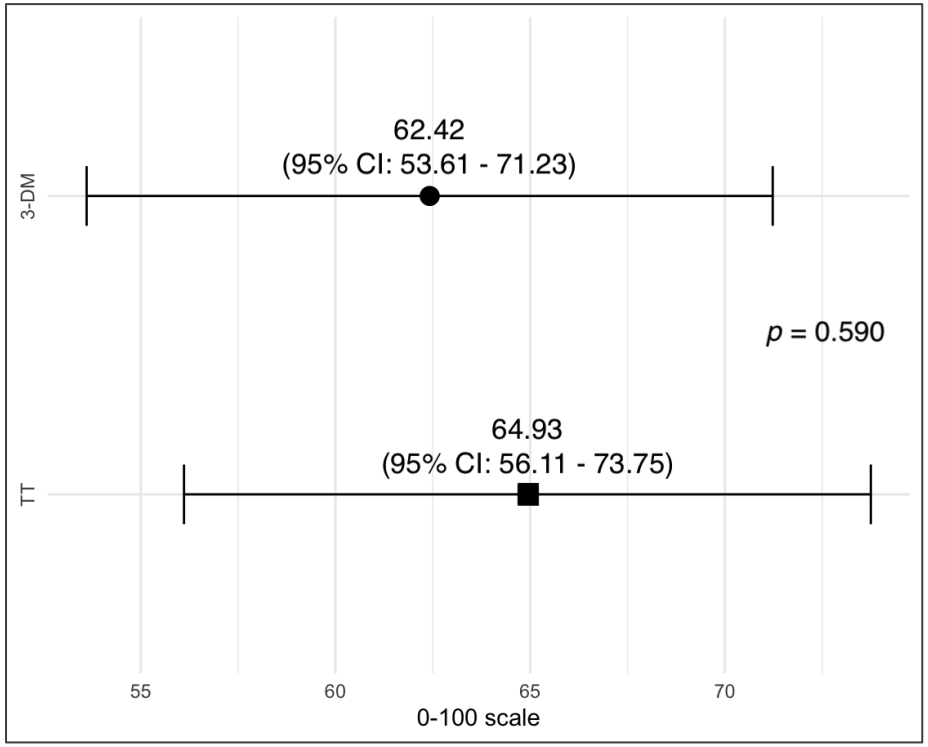
Mean Difference



Results – Confidence to Perform Cricothyrotomy



Pooled



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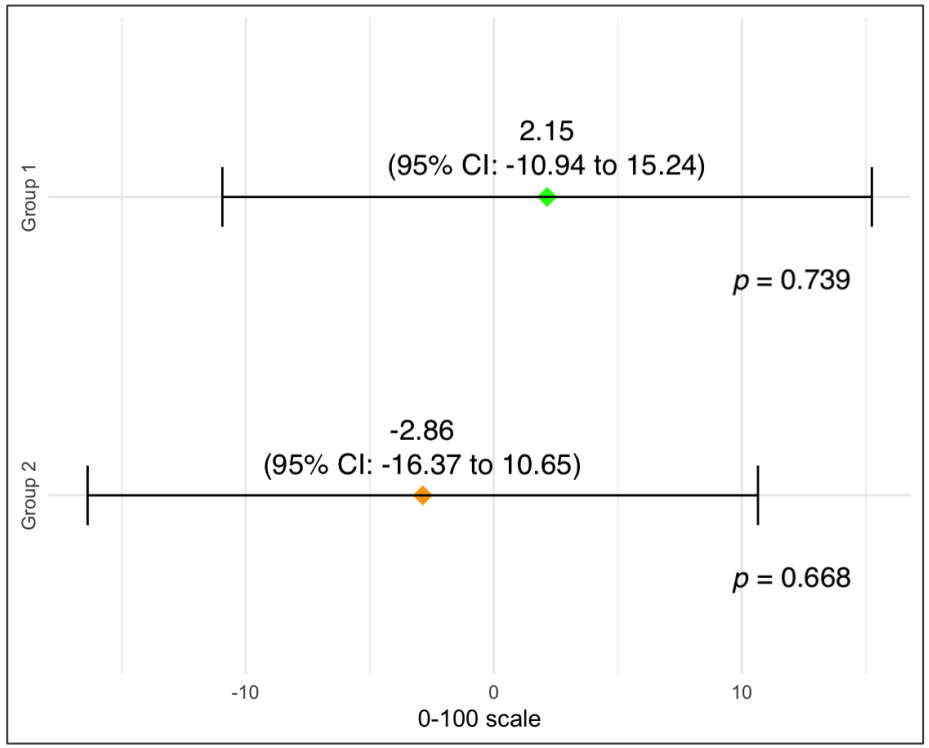
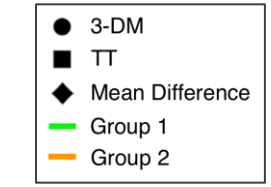
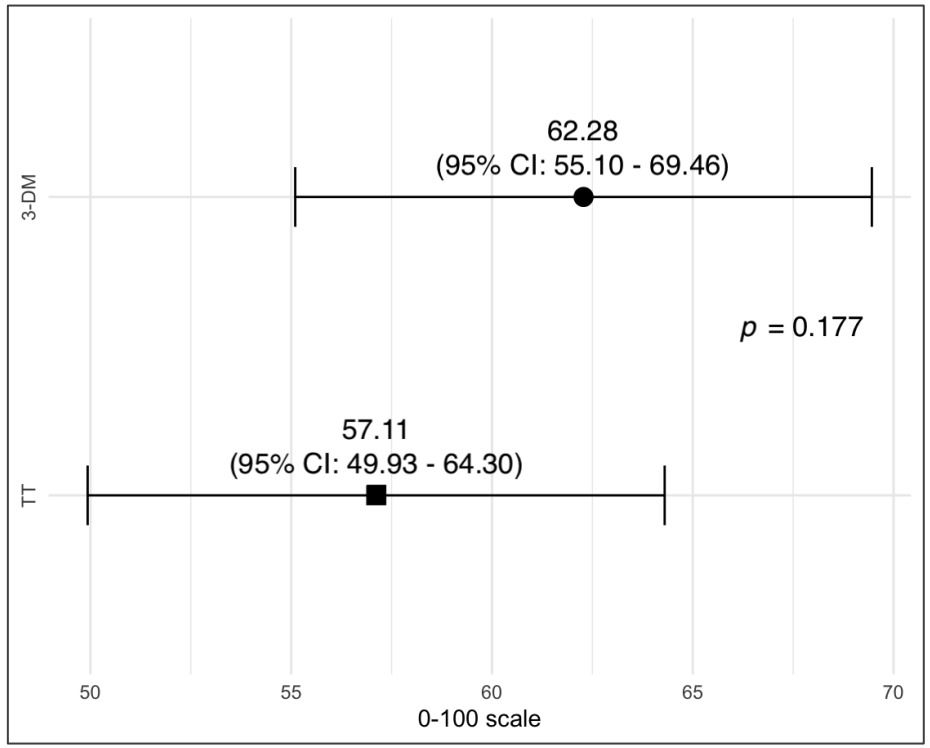


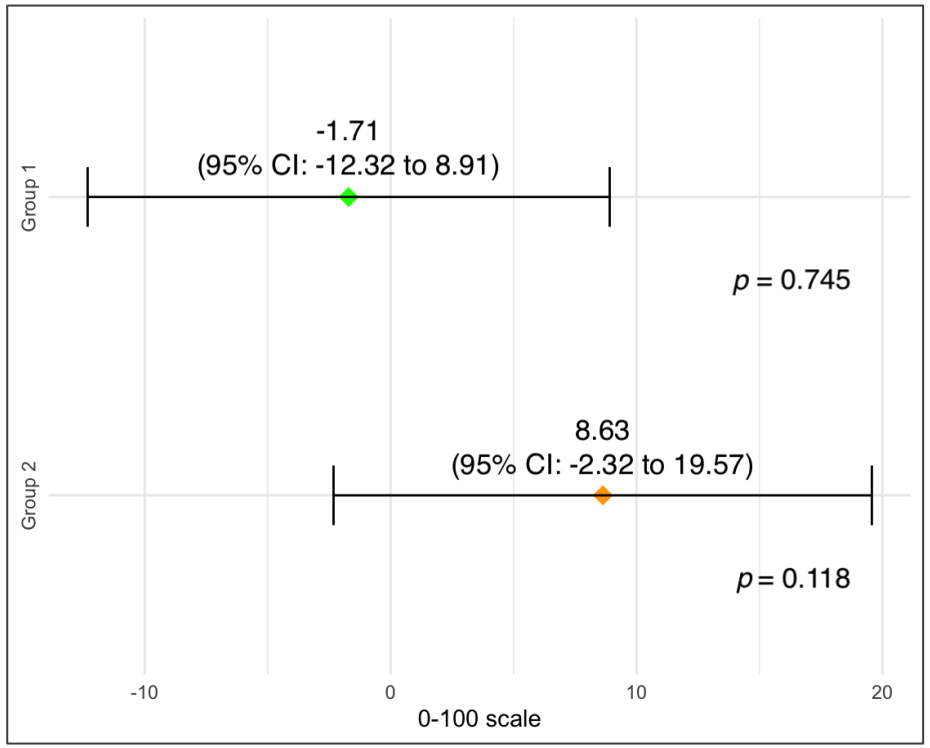
Results – Realism



Overall



Mean Difference

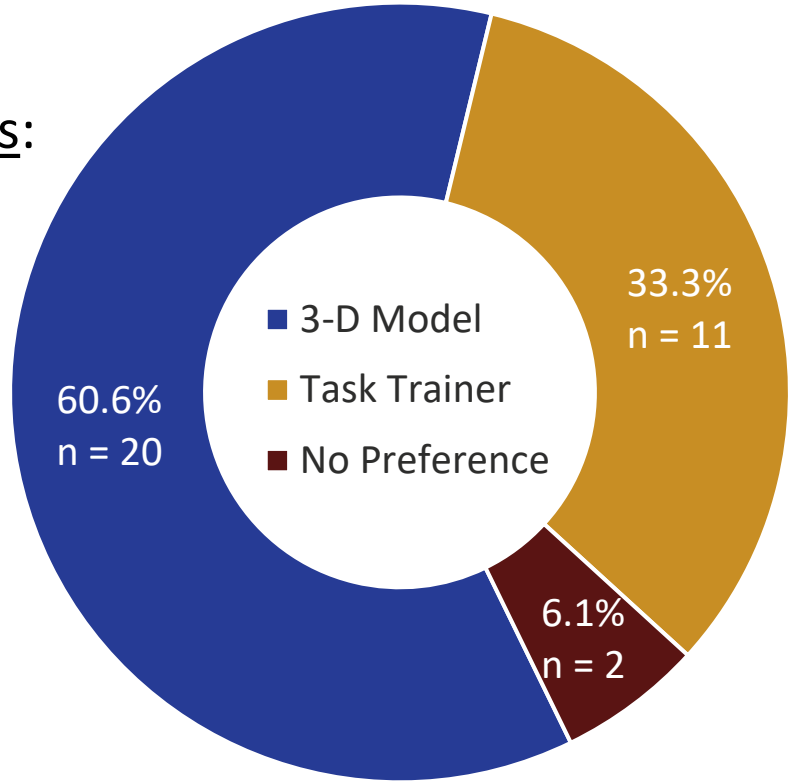


Results – Preferred Training Model

3-D Model Preference drivers:

85% - Tactile / Feel (n = 17)

70% - Realism (n = 14)



p = 0.472

Task Trainer Preference drivers:

100% - Tactile / Feel (n = 11)

36% - Personal Performance (n = 4)

18% - Realism (n = 2)

Discussion

- When compared with 3-DM, the TT was associated with:
  - Faster procedural times ($p = 0.03$*)
  - Enhanced confidence to perform cricothyrotomy ($p > 0.05$)
  - Lower ratings for realism and preference
- Students who used the TT first, had less successful attempts overall

- **The impact of different cricothyrotomy training models on skill acquisition, skill maintenance, and clinical performance remain unknown

Conclusion

- Cricothyrotomy performance times slower with 3-DM than TT
- Similar performance between training models:
  - Cricothyrotomy success
  - Confidence
  - Realism ratings
- 3-DM preferred over the TT for its tactile feel and realism
- 3-DM may provide a valuable alternative cricothyrotomy training option
- Additional evaluation is required

References