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Evaluation of Remote Telemedicine Support and Physiological Closed Loop Control for Fluid Resuscitation in Simulated CASEVAC

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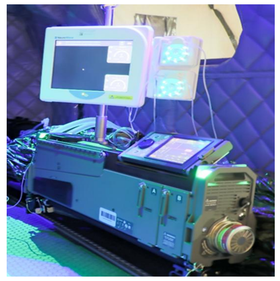
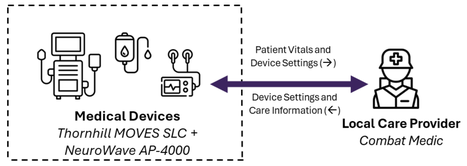
Introduction

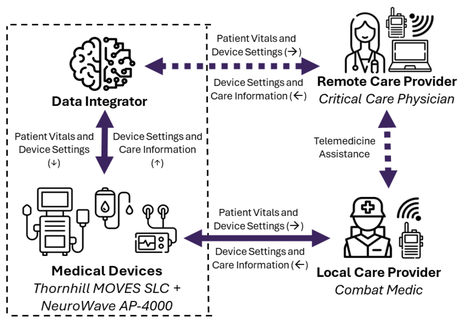
- Preliminary research shows promise for physiological closed-loop control (PCLC) algorithms and telemedicine with remote management technologies to improve combat casualty care.
- The objective of this research is to evaluate impact of these technologies on medic treatment performance, operational efficiency, task management and cognitive workload compared to conventional unsupported care in realistic operational settings.

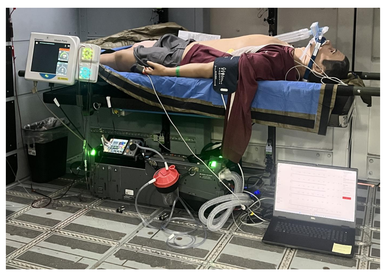
This study measures medic performance when utilizing the different technologies, not the performance of the technologies themselves

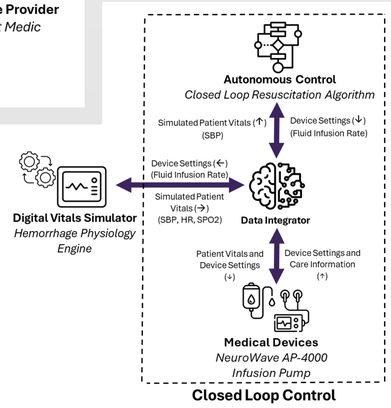
Technology Testbed











Methods

Design: Randomized crossover trial - each medic completes all three 30-minute study arms. Study will take place at Ft Rucker, Alabama in partnership with USAARL.

Participants: Army Combat Medics (68W)

Setting: Simulated, confined MEDEVAC environment. Data collection will utilize NAVAIR's MMVI Technology Demonstrator for additional operational realism.

Study Arms:

Unsupported Care
Medic manually operates all devices with no external support.

Telemedicine Support
Remote physician provides guidance and adjusts device settings.

Autonomous Support
Autonomous blood infusion management using real-time vitals.

Data Collection Measures:

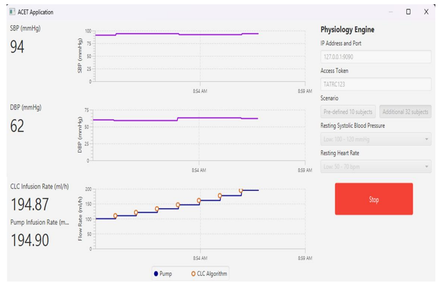
- Time and quantity of medical tasks completed (workload)
- Time to achieve target systolic blood pressure
- Percent deviation of SBP from target (100 mmHg)
- Post-scenario surveys (experience with scenarios and technology)
- NASA TLX (task load)
- Jian Trust Scale (trust in technology)

Software Refinements

Enhanced Usability -Streamlined interface, for intuitive medic interaction

Reduced Form Factor -Optimized for ruggedized tablet to improve form factor

Optimized Integration- Improved closed-loop control and the physiology engine coupling for improved software reliability



Results

A dry run was conducted in February 2026 with a USAARL 68W study team member to validate study design and procedures. This exercise was valuable for refining methods but did not generate research data. Based on prior research focusing on clinician use, we anticipate:

- ✓ **Positive opinions of the remote control with telemedicine and closed loop control technology support**
- ✓ **Increased casualty care delivery efficiency**
- ✓ **Reduction in provider workload using assistive technologies**

Data collection is scheduled for Summer 2026, with a target enrollment of 9 participants. A full report of the quantitative and qualitative analysis is anticipated for publication by Fall 2026.

Conclusions

- Insights into how medics engage with diverse support modalities will drive the design of intuitive, reliable systems that optimize human-machine teaming and accelerate technology adoption in austere environments.
- Findings will directly inform the evolution of prolonged field care protocols and shape technology integration strategies for operational military medicine.
- This research establishes critical foundational data to advance remote-controlled and autonomous medical technologies, ensuring operationally relevant and effective deployment.

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