

Sustained Stress After Tactical Combat Casualty Care (TCCC): Implications for Prolonged Casualty Care (PCC)

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BACKGROUND

- Navy corpsmen are highly versatile and deployable. They must prepare for prolonged casualty care in large-scale combat operations (LSCO) with limited resources, and stress.
- TCCC prepares corpsmen for initial trauma management, but little is known about how stress responses evolve before, during and after high-intensity trauma care.
- Research examining multimodal stress responses during TCCC is limited, and even fewer studies focus on Navy corpsmen who frequently serve as single providers in austere locations.
- This study evaluates stress trajectories before, during, and after an immersive high-fidelity TCCC simulation and examines how these stress responses relate to performance.

PURPOSE

- The purpose of this study was to determine the effects of a TCCC course simulation on the psychological, physiological and psychophysiological stress response of participants at baseline, before, during, immediately after, and at 20 and 40 minutes after the simulation.

METHODS

- Study Design: Single-center, prospective observational study of Navy corpsmen enrolled in TCCC training at a Military Treatment Facility.
- Participants: Convenience sample of 64 corpsmen who completed all simulation-day data collection.
- Psychological Stress Measures: State-Trait Anxiety Inventory; Physiological Stress Measures: Salivary cortisol; Heart rate.
- Psychophysiological Stress Measures: Heart rate variability (HRV) indices derived from Zephyr™ Bioharness.
- Data Collection Timepoints: Baseline; 10 minutes pre-simulation; Immediately post-simulation; 20 minutes after simulation onset; 40 minutes after simulation onset.
- Performance Assessment: Standardized Navy TCCC checklist.
- Statistical Analysis: Repeated measures ANOVA to evaluate stress changes over time.

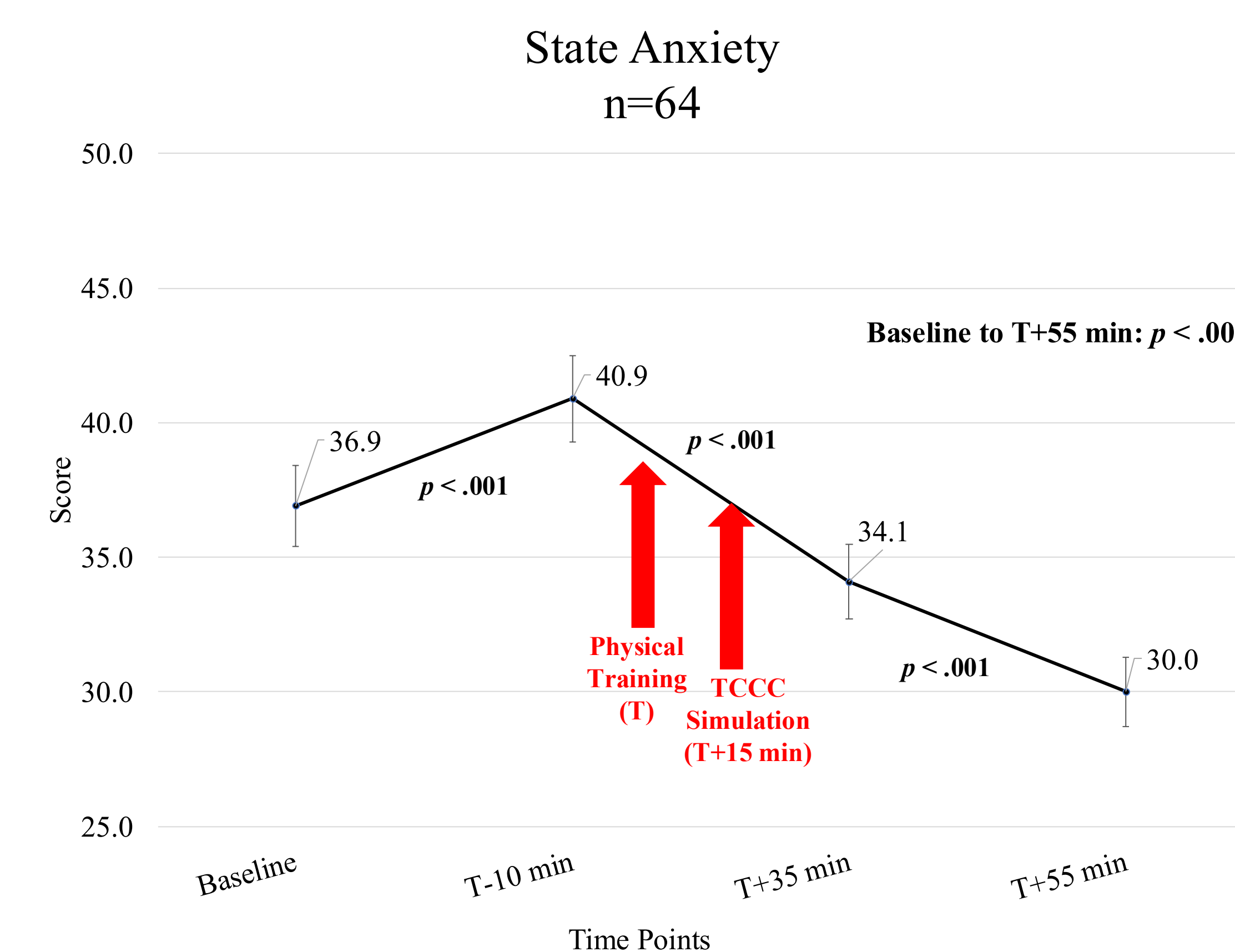
RESULTS

Table 1. Demographics

Total Enrolled: n=70; Mean Age: 26	Male: 40 (57.1%)
Rank E-1 to E-3: 23 (34.3%)	Took TCCC course = 1 time: 42 (66.7%)
Rank E-4 to E-6: 44 (65.7%)	Took TCCC course ≥ 2 times: 21 (33.3%)

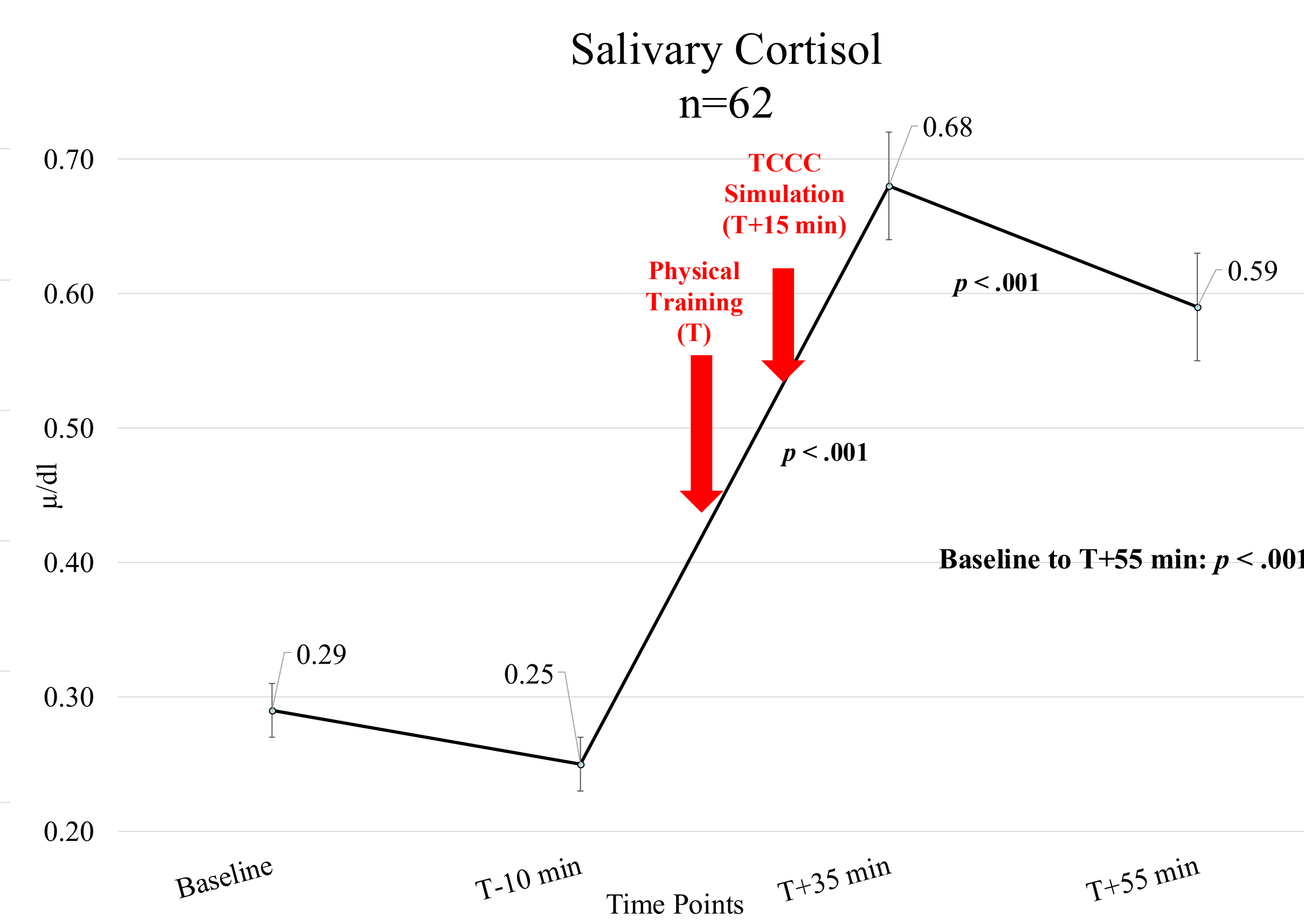
Note. Values are Valid Percentages

Figure 1. RM-ANOVA for State Anxiety



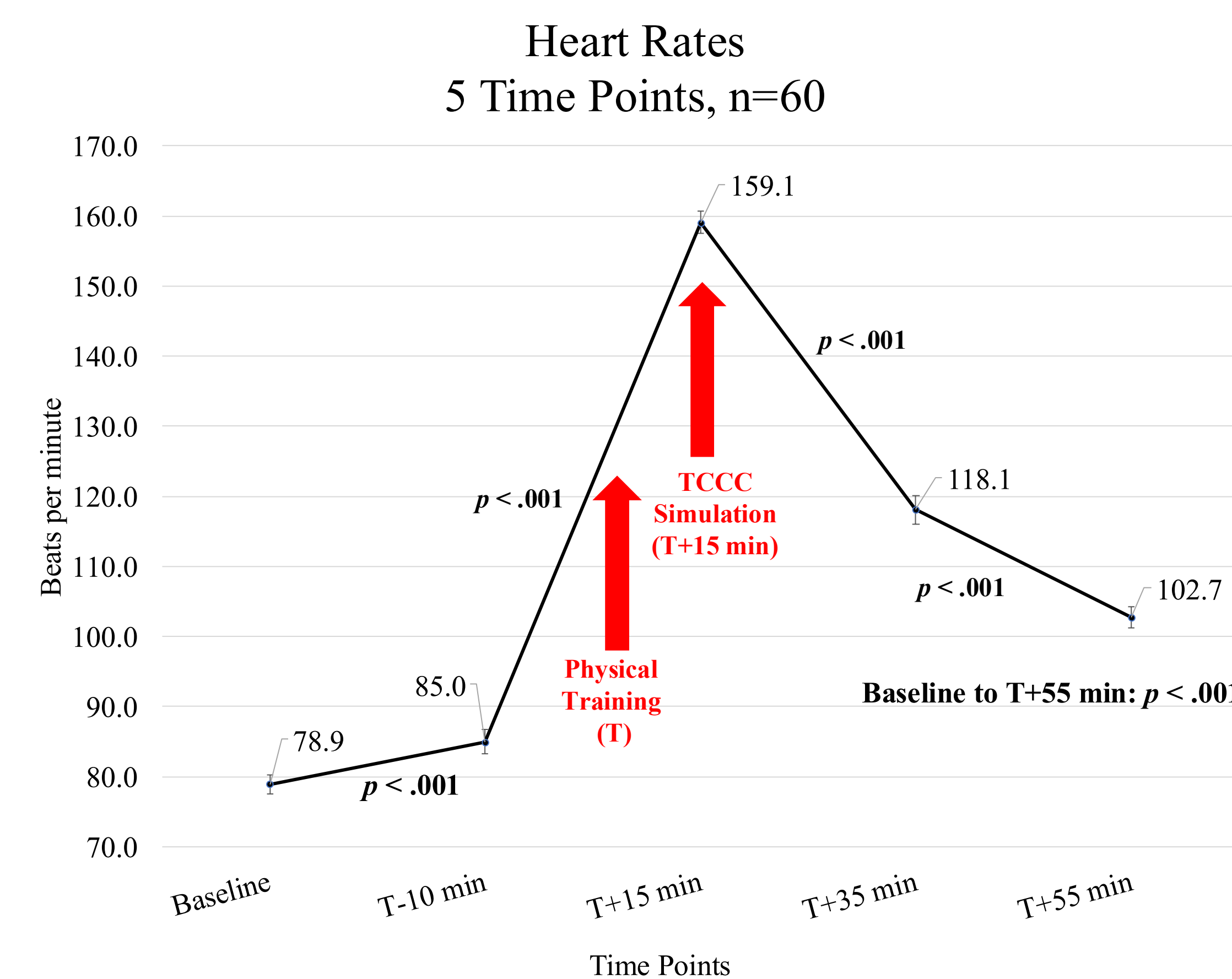
Note. Mean ($\pm$ Standard Error). RM-ANOVA: $F(1.6, 103.3)=20.6, p < .001$

Figure 2. RM-ANOVA for Salivary Cortisol



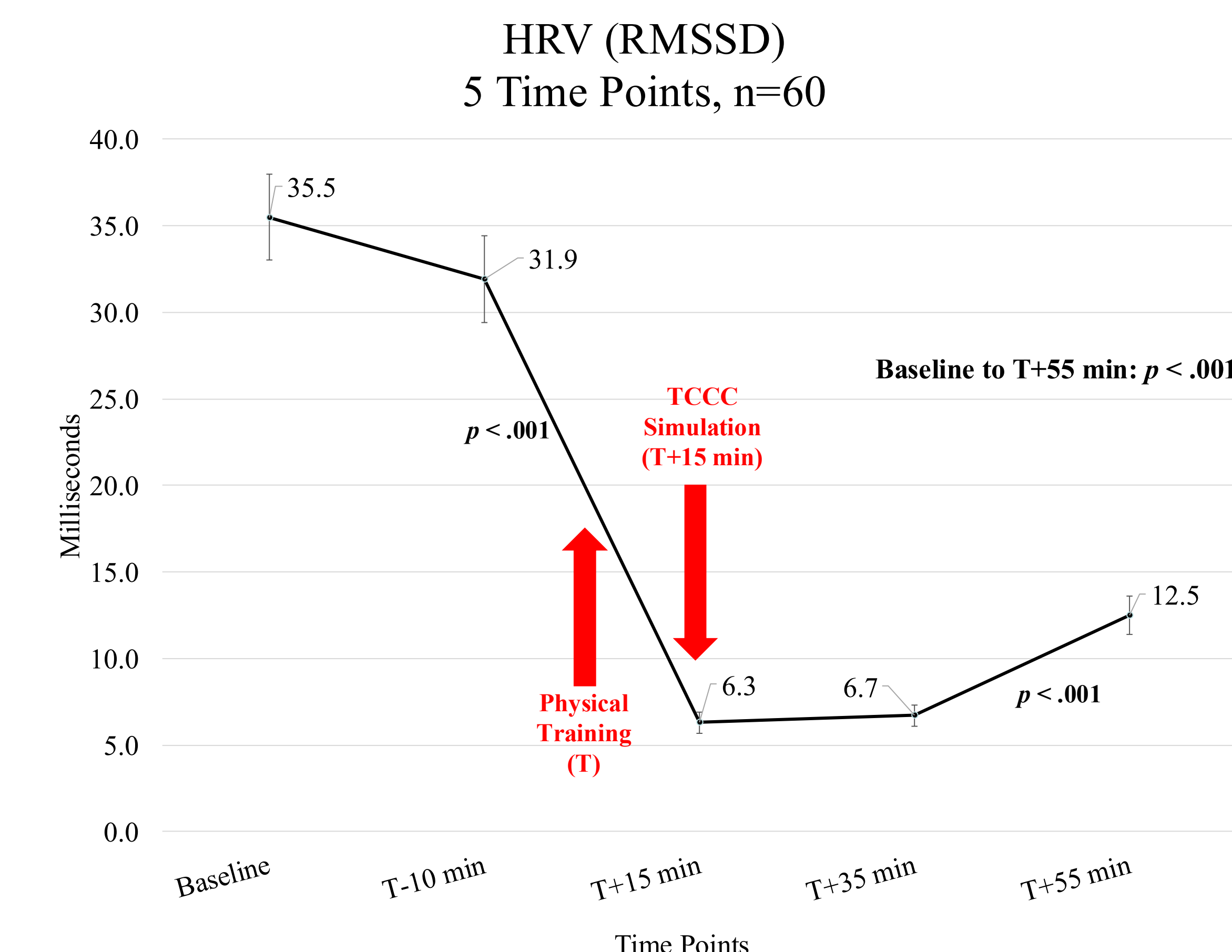
Note. Mean ($\pm$ Standard Error). RM-ANOVA: $F(1.7, 104.1)=78.8, p < .001$

Figure 3. RM-ANOVA for Heart Rate



Note. Mean ($\pm$ Standard Error). RM-ANOVA: $F(2.5, 145.0)=878.6, p < .001$

Figure 3. RM-ANOVA for Heart Rate Variability



Note. Mean ($\pm$ Standard Error). RM-ANOVA: $F(1.8, 105.6)=107.6, p < .001$

DISCUSSION

- Immersive TCCC scenarios produced strong and sustained multimodal stress responses in Navy corpsmen, with clear sympathetic activation before, during, and after the event.
- Stress markers showed incomplete recovery, with cortisol, heart rate, and HRV remaining elevated or suppressed well into the recovery period, suggesting corpsmen may remain in stressed states during sequential critical tasks in PCC.
- Findings indicate that cognitive and emotional demands, not physical exertion alone, drive significant sympathetic activation. Both physical strain and psychological stressors will likely compound during LSCO.
- Sustained autonomic activation may degrade working memory, attention, reasoning, and situational awareness, thereby increasing the risk of cognitive errors during extended or repeated casualty care.
- Training models should emphasize hands-on repetition, realistic stress exposure, structured recovery, and physiological down-regulation techniques, while expanding military-civilian trauma partnerships to increase real clinical experience.
- Persistent HRV suppression highlights HRV's potential as a biomarker for resilience and early stress dysregulation, supporting targeted recovery strategies and stress inoculation approaches during training and operational cycles.

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