

Heart Rate as a Real-Time Stress Measure in Collegiate EMS

C. Simon¹, EMT-B RBT; T. Galloway¹, EMR

¹Gator Emergency Medical Response Unit, University of Florida



ABSTRACT

Stress is an acute, neuropsychological reaction that often induces activation of the sympathetic nervous system known as the ‘fight or flight’ response¹⁻³. This autonomic response appears with increased stimulation of the cardiac nodes, provoking measurable, sustained tachycardia^{2,3}. Stress dysfunction is associated with cognitive impairments, psychiatric conditions and long-term disease risk in EMS responders⁵⁻¹⁰. Current measures of stress dysfunction use self-reporting and psychometric scales that are subject to biases¹¹⁻¹³. The primary objective of the study was to determine real-time biophysical responses to stress in the form of heart rate data in collegiate EMS populations.

INTRODUCTION

Stress is an acute, neuropsychological reaction that often induces activation of the sympathetic nervous system known as the ‘fight or flight’ response¹⁻³.

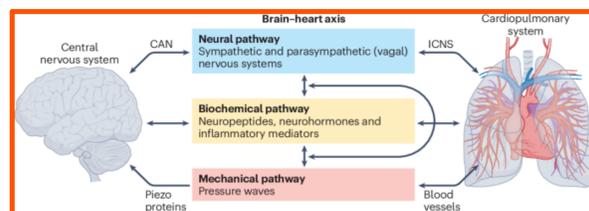


Figure 1: Brain-Heart Axis⁴

This autonomic response appears with increased stimulation of the cardiac nodes, provoking measurable, sustained tachycardia^{2,3}. Stress dysfunction is associated with cognitive impairments, psychiatric conditions and long-term disease risk in EMS responders⁵⁻¹⁰. Current measures of stress dysfunction use self-reporting and psychometric scales that are subject to biases¹¹⁻¹³. The primary objective of the study was to determine real-time biophysical responses to stress in the form of heart rate data in collegiate EMS populations.

METHODS

This study was approved by the University of Florida Quality Improvement Registry Program (QIPR2926) as a department of the University’s Institutional Review Board. Student EMS responders ($n=10$) wore Polar H9 ECG chest straps while staffing either a regularly scheduled 911 shift or medical standby at a special event. For each participant, data was collected over one-hour intervals and during call response across a single shift. Baseline data was denoted as anytime that the participant was not responding to medical emergencies. Heart rate data was analyzed using descriptive, temporal, and inferential statistics.

RESULTS

Figure 2: Temporal Analysis of Heart Rates with Call Response

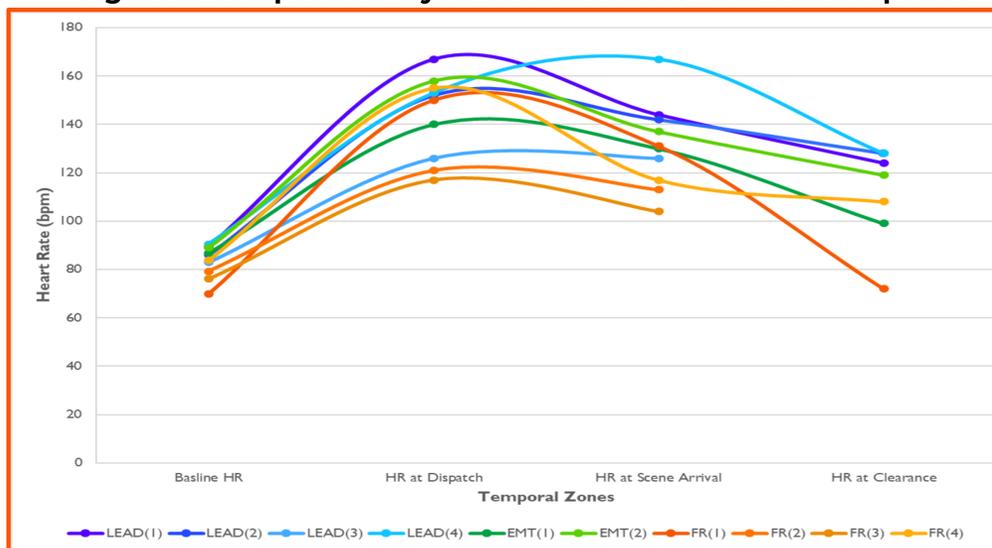


Figure 3: Comparing Differential Heart Rate Changes^{14,15}

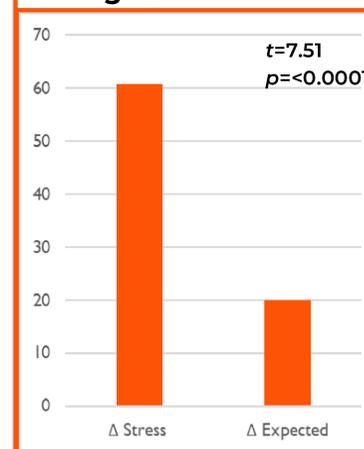
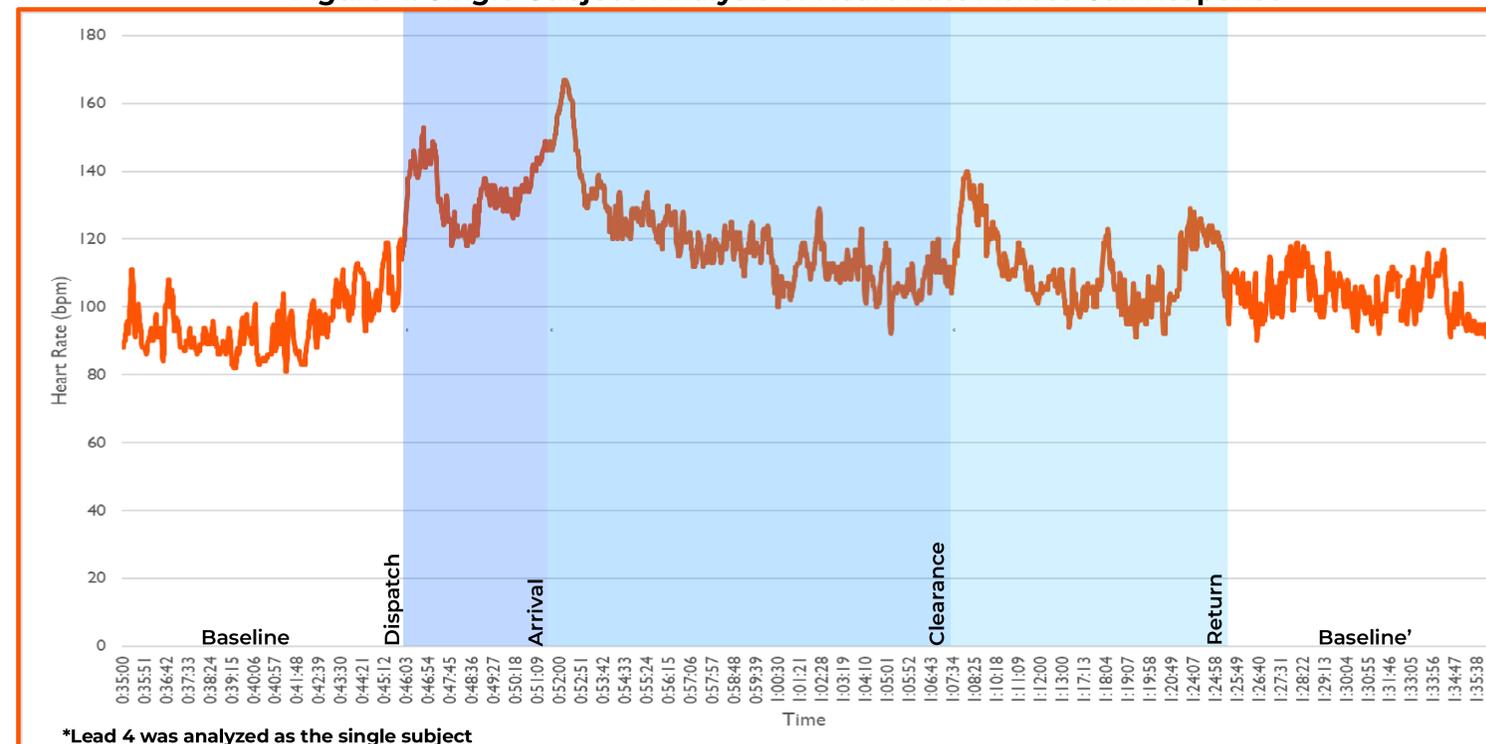


Figure 4: Single-Subject* Analysis of Heart Rate Across Call Response



*Lead 4 was analyzed as the single subject

DISCUSSION

Stress response from sympathetic activation is correlated to call response and demonstrated by larger deviations from baseline than normal autonomic oscillations. Biophysical stress is also seen to be influenced by dispatch, scene arrival, and patient care, highlighting the need for multifaceted interventions. Calls recorded in this study were low-acuity and routine in nature. We hypothesize that high-acuity calls will produce stronger sympathetic effects, leading to increased deviations from and difficulties returning to baseline function. Heart rate data can be used as a real-time measure of biophysical stress response, showing objective changes in a collegiate EMS responder’s sympathetic activation throughout the course of a call. Stress dysfunction found in this project matches psychometric responses in the literature, validating this measure for future research.

FUTURE AIMS

- Combine psychometric and biophysical measures
- Track stress response in high-acuity calls
- Measure efficacy of stress interventions

REFERENCES

The authors declare no conflicts of interest. The authors would like to thank Dr. Sarah Vas and Dr. Joel Rowe for their assistance on this project. References are attached.



CONTACT INFORMATION

Cole Simon, EMT-B RBT
colesimon@ufl.edu; (407) 353-0181