PHYSIOLOGICAL STRESS ACCUMULATION IN LAW ENFORCEMENT OFFICERS ACROSS A MULTI-DAY ACTIVE SHOOTER TRAINING COURSE

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Introduction

- Research on training scenarios in law enforcement officers (LEOs) has previously focused on officer performance (decision making, accuracy, etc.) rather than the physiological demand of the activity (2).
- Active shooter training is designed to prepare officers to respond to various scenarios in which they receive reports of an armed suspect.
  - This course is required to be completed, at minimum, every five years for incumbent officers and before academy graduation for recruits in this municipality.
- Heart rate variability (HRV) has often been used as an indicator of physiological stress in tactical populations (3).
  - Higher HRV is used as an indicator of "readiness", though there has been debate as to what cutoff point constitutes a high HRV.

Purpose

The purpose of this study was to investigate the physiological stress accumulation (measured via HRV) in LEOs during a multi-day active shooter training course.

Methods

- Seven officers (age: 37 ± 12.12 years; height: 176.71 ± 8.66 cm; body mass: 90.26 ± 18.50 kg) participated in this training class.
- This data was collected over the course of four days, and the course consisted of multiple scenarios and officer interactions with a "suspect" and/or "victims" (played by training officers and live role players).
- Zephyr heart rate (HR) monitors were used to collect physiological data, while training duration was collected by the investigative team.
  - Zephyr calculates HRV on a rolling 300 beat standard deviation of the normal-to-normal intervals (SDNN).
- Each day of training was separated into the following categories:
  - Active: participation in training scenario
  - Inactive: practice runs, rest time, briefing/debriefing
  - Total Time: active participation plus inactive time
- A repeated-measures ANOVA was used to identify changes in active, inactive, and total HR, HRV and training durations across the four day course ($p ≤ 0.05$).

HRV was significantly reduced over four days of training, suggesting the accumulation of physiological stress.

Figure 1 (top left): Daily fluctuations in active, inactive, and total average heart rate by day of training.
Figure 2 (top right): Daily fluctuations in active, inactive, and total average heart rate variability by day of training.
Figure 3 (bottom): Training duration separated by active, inactive, and total time across days of course.
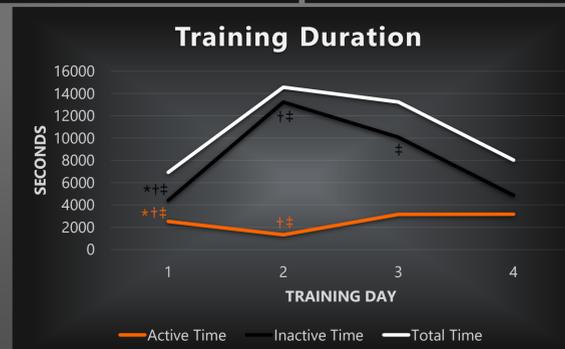
Symbol Legend:
* Denotes significant difference from day 2 of training.
† Denotes significant difference from day 3 of training.
‡ Denotes significant difference from day 4 of training.
Note: $p ≤ 0.05$; The color of the symbol indicates the variable to which it is referring.

This information may strengthen the need for recovery techniques in LEOs to reduce accumulated physiological and psychological stress.

Results

- Figures 1, 2, and 3 depict daily fluctuations in HR, HRV, and training duration among the subject pool. Findings of note include:
- Active and total HRV were significantly lower on day four compared to day two ($p ≤ .001$ and $.008$, respectively).
- Total HR was significantly higher on day one compared to days two and three ($p = .033$ and $.002$, respectively), and was significantly lower on days two and three compared to day four ($p = .021$ and $.018$, respectively).
- Active scenario participation was significantly shorter on day one than days three and four ($p = .005$ and $.002$, respectively), and day two active scenario participation was significantly shorter than all other training days ($p ≤ .001$).

Conclusion

- The first and last days of training elicited higher HRs during scenario participation than the other training days. This is presumably due to day one being the first introduction to the scenarios, while day four included the longest duration scenarios that were reflective of the culmination of skills.
- Day one resulted in the lowest amount of inactive time compared to all other training days ($p ≤ .02$), which could indicate that there were insufficient recovery periods between scenarios to reduce HR.

Practical Applications

- **HRV has been shown to be sensitive to cognitive processing tasks, especially when sustained attention is required (1).**
- **The prolonged and observed physiological stress observed could be representative of variable shift work, special teams and assignments, and in worst case scenarios, real-world active shooter events.**
- **This information may inform future training sessions in LEOs.**

References

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