# *Evaluating the Effect of Heat Stress on Firefighters*

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**Purpose:** This interdisciplinary study was designed to test emerging monitoring technology to detect adverse effects of heat stress on firefighters cardiovascular, neuromuscular, and cognitive systems during live burn events.

**Background:** Sudden cardiac death is a primary cause of on-duty firefighter deaths. Heat stress and over exertion impact cardiovascular, neuromuscular, and cognitive systems. Real-time feedback of physiological responses has the potential to allow incident commanders to remove firefighters from heat exposure and over exertion situations as they approach physiological limits, thus preventing on-duty injuries or fatalities.

**Design:** All subjects signed informed consents as per the approved IRB protocol. Data collection process was designed around the firefighters' Live Burn firefighting and ladder traversing trainings. The trainings included 3 scenarios lasting approximately 10 to 20 minutes each followed by a rest period. Objective and subjective measures were gathered prior to the trainings (baseline) and at pre-scenario and post-scenario events throughout the trainings. Core Body Temperature and Polar Heart Rate and/or Bioharness data were gathered continuously throughout the trainings.

**Methods:** Core body temperature (CBT) and heart rate (HR) were monitored continuously during three training scenarios using an FDA approved ingestible radio pill, Polar HR chest strap or Zephyr Bioharness, and a CBT data recorder. The three scenarios included search and rescue, hose advancement, and backup or three scenarios of ladder climbing. Rest measurements of blood pressure (BP), pulse, SpO2, tympanic temperature, height and weight were obtained. Pre- and post-scenario measurements of BP, pulse, SpO2, tympanic temperature, reaction times (RT), perceived exertion (RPE), perceived respiratory distress (RD), perceived thermal comfort (TC), postural sway, and height and weight were obtained.

**Results:** Real-time continuous CBT and Polar HR data increased as the firefighters progressed through each scenario. Past results support the validity of using real-time monitoring of firefighters physiological responses during live burn events and the potential for systems to identify and remove firefighters from harmful situations.

**Conclusion:** We have examined the objectives of quantifying objective and subjective measures and of determining the association between these measures of heat stress and overexertion associated with Live Burn activities and other trainings carried out by firefighters. Further data collection will be performed to determine if the results obtained so far will be sustained.

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