Evaluating the Effect of Heat Stress on Firefighters

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Purpose: The purpose of this research study is to investigate the effects of heat stress on cardiovascular, neuromuscular and cognitive systems of firefighters. Sudden cardiac death has been determined to be the primary cause of on-duty firefighter deaths. The focus of this research is to assess and reduce firefighters on-duty risks by utilizing emerging technologies to control firefighters adverse reactions when exposed to heat stress and physical exertion. The ultimate goal is to develop an exposure measurement system that will allow incident commanders to pull firefighters out of situations prior to incidents that result in on-duty injury or fatality.

Design: The data collection process has been designed around the firefighters live burn trainings. The live burn trainings involve three scenarios with rest periods in between. The scenarios include three evolutions that last approximately ten minutes each and which involve search and rescue, hose advancement, and backup procedures.

Methods: During the October 2011 data collection full-time firefighters were recruited from the Sycamore Township fire department. The data was collected during their regularly scheduled live burn trainings. Measurements were taken at baseline, pre-scenario, and post-scenario times. These measurements included blood pressure, pulse, oxygen saturation (SPO_2), skin temperature, reaction time, Borg rating of perceived exertion (RPE), respiratory distress, and thermal comfort. The subjects were given FDA approved radio pills during the time that consent forms were obtained and baseline data was gathered. Prior to the start of live burn training the core body temperature (CBT) devices were synchronized, polar heart rate (HR) belts were applied, and pre-scenario data was gathered. The use of CBT and polar HR devices allow for continuous live monitoring throughout the training.

Results: There appears to be an association between exposure to elevated temperatures and the firefighters increased perception of physical exertion, respiratory distress, and thermal discomfort. The mean HR, skin temperature, CBT, and polar HR increased at pre-scenario stage and remained elevated, while there was a decrease in SPO_2 levels that occurred after an initial increase at the pre-scenario stage.

Conclusion: A limitation with this data collection is having only six subjects from one fire department. Recruiting subjects from different fire departments is another consideration that needs to be addressed to strengthen this study.

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