FIREFIGHTER PHYSIOLOGICAL MONITORING TECHNOLOGY SUMMIT
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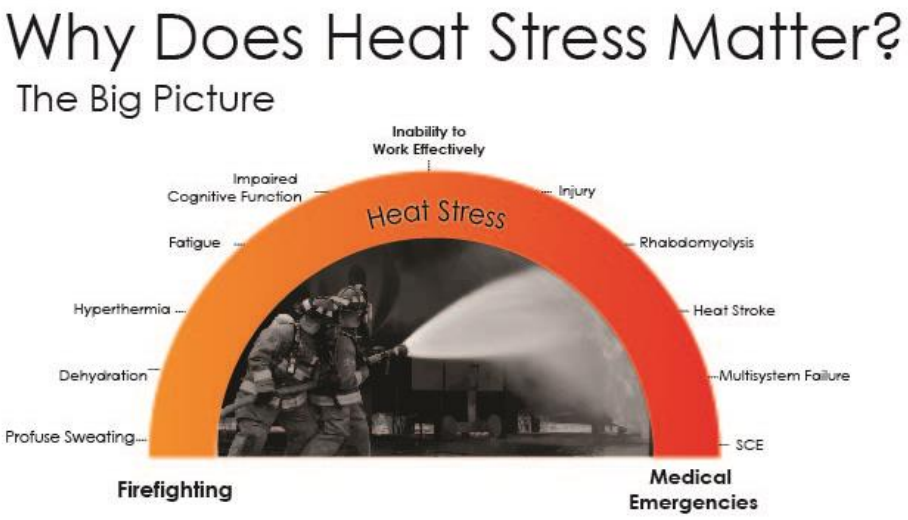
Enhancing an Algorithm to Accurately Estimate Core Temperature

BACKGROUND AND MOTIVATIONS

- The high ambient temperatures, encapsulating PPE, and heavy work associated with firefighting result in elevations in body temperature.
- There are serious consequences associated with heat stress:
  - Early onset of fatigue
  - Increased cardiovascular strain
  - Impaired cognitive function
  - Heat illnesses such at heat exhaustion and heat stroke



- The SMARTER team started with an algorithm developed by and for the military to estimate core body temperature and is developing and validating an algorithm for use among firefighters.

CHALLENGES

- Having accurate technology in a convenient wearable form that is affordable
- Determining appropriate thresholds for notification
- Creating an easy-to-use notification system to indicate when firefighters are at risk for heat illness or have recovered
- Firefighters' fears of being taken off-line
- Liability concerns—consequences associated with using/not using the data

CHALLENGES OF MEASURING HEAT STRESS ON THE FIREGROUND

- *Oral measurements* are affected by fluid intake, smoking, and chewing.
- *Rectal measurements* are not practical.
- *Infrared measurements* are altered by ambient temperature and are inaccurate during work.

KEY FINDINGS AND RECOMMENDATIONS

- Findings from military studies suggest the algorithm provides an accurate estimate of core body temperature.
- Preliminary tests with a small number of firefighters also indicate that the algorithm provides accurate estimates of core body temperature.
- Additional testing with a large number of firefighters with a wide range of descriptive characteristics (age, body mass index, etc.) is required.
- Appropriate estimated core temperatures at which a firefighter should rest or return to duty are required (go/no gos).
- Devices that incorporate the enhanced algorithm need to be low-cost and portable.
- Technologies that measure heart rate may be able to incorporate the final improved algorithm to estimate core temperature, thus providing a more comprehensive measure of physiological strain.