



Firefighter Fatalities and Injuries: The Role of Heat Stress and PPE

Illinois Fire Service Institute – Research Project Summary

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The leading cause of firefighter line of duty deaths is heart attacks. Furthermore, one of the major sources of fireground injuries are slips, trips and falls. Research suggests that heat stress may be a common factor in both of these incidents and that changing the design of personal protective equipment (PPE) can potentially mitigate them both.

A year long research program at the Illinois Fire Service Institute Firefighter Life Safety Research Center funded by a Department of Homeland Security Fire Prevention & Safety Grant has culminated in a new report, *Firefighter Fatalities and Injuries: The Role of Heat Stress and PPE*. The report provides a review of the previous research and results from our study concerning heat stress, cardiovascular function, firefighter biomechanics and the design of personal protective equipment. A few of the key findings from this study include:

- Almost 65% of the participants –who were young, relatively healthy firefighters - were pre-hypertensive or hypertensive, which is one of the major risk factors for developing cardiac disease.
- We measured significant increase in clotting potential as measured by an increase in platelet number and activity, increased coagulatory

variables and altered fibrinolysis after only eighteen minutes of firefighting activity. These changes suggest a potentially hypercoagulable state post-firefighting.

- When firefighters donned structural PPE, we measured significant changes in balance and gait as compared to wearing a station uniform. This result suggests that any response in firefighting PPE is likely to change a firefighter's biomechanics, potentially increasing the risk for slips, trips, and falls.

A copy of the *Firefighter Fatalities and Injuries: The Role of Heat Stress and PPE* report is being made available in both hard copy and on-line at the IFSI website. We encourage all who are interested to pick up a copy and feel free to contact us with any questions.

Gavin Horn has served as the IFSI Research Program Manager since August 2004, immediately after receiving his PhD in Mechanical Engineering from UIUC. Dr.

Horn's research interests lie in the areas of firefighter health and safety, tool design, material testing and design, and infrared imaging.

Denise L. Smith is a Professor and Chair of the Department of Exercise Science, Dance and Athletics at Skidmore College (NY). Since 1994 she has also been a visiting research associate at the University of Illinois Fire Service Institute. Dr. Smith received her PhD in Kinesiology from the University of Illinois at Urbana-Champaign with a specialization in Exercise Physiology. She is co-author of a textbook titled "Exercise Physiology: For Health, Fitness and Performance." Her funded research is focused on the physiological effects of heat stress, specifically the cardiovascular strain. ■

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