

PHYSIOLOGICAL EFFECTS OF FIREFIGHTER CREW SIZE

Decisions about firefighter crew sizes are typically made from the perspective of protecting the public with additional consideration given to protecting firefighters from the dangers of structural collapse and other risks.

However, a leading cause of firefighter line of duty fatalities is overexertion/overstrain (Fahey 2005). Based on United States Fire Administration (USFA) data, 43.9% of all firefighter fatalities from 1990-2000 were due to cardiac events, nearly double the second leading cause of death (trauma) (USFA, 2002). There is strong epidemiological evidence that heavy physical exertion can trigger sudden cardiac events (Mittleman et al. 1993; Albert et al. 2000). Therefore, understanding the effect of crew size on the physiological strain experienced by the firefighter is of great importance.

A study conducted by Skidmore College and coupled with the Residential Fireground Field Experiments investigated the cardiovascular strain experience by firefighters as a function of the crew size that was deployed to suppress a “typical” low-hazard fire.

Figure 1 depicts the average peak heart rate for the crews of Engine 1 (first arriving engine) when varying crew sizes were deployed. The average peak heart rates for firefighters on the 1st Engine were above 80% of age-predicted maximum values when only 2 firefighters were deployed. In fact, the driver had an average peak heart rate of nearly 90% of age-predicted maximum when there were only 2 firefighters on the engine. When 3 firefighters were deployed per apparatus the peak heart rate averaged 72% across the three positions, and this value varied slightly when 4 firefighters (average 71%) were deployed.

Figure 1

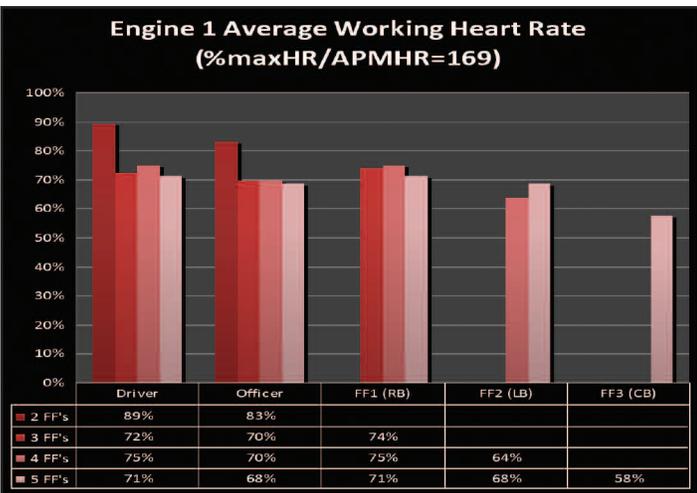


Figure 2 depicts the heart rate response of crew members throughout the fire suppression activities when a crew of two firefighters was deployed and when a crew of five firefighters was deployed. This graph reveals that heart rates remain elevated throughout the firefighting activities. The graph also reinforces the information presented earlier, namely that cardiovascular strain, as reflected by heart rate, was higher when a crew of 2 firefighters was deployed than when a crew of 5 firefighters was deployed. Both peak heart rate and the heart rate sustained throughout the fire suppression activity was higher when only 2 crew members were deployed.

Figure 2

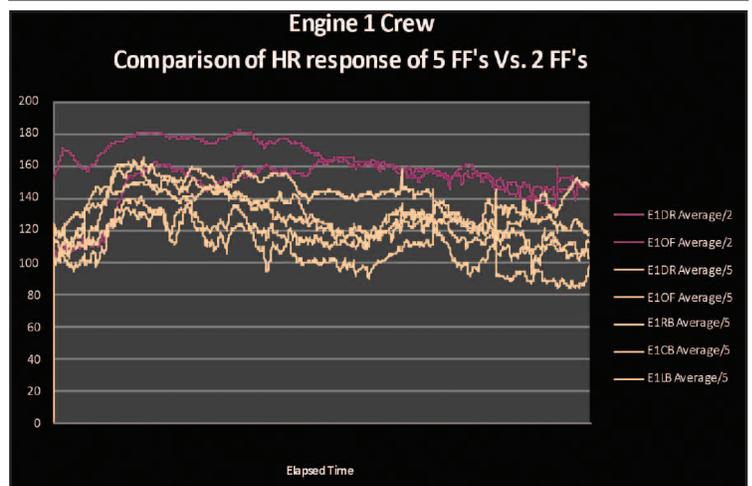


Figure 2. Heart rate responses of first engine (E1) crew members with different crew sizes.

The heart rates reported in this study are consistent with previously published research (Romet and Frim, 1987). However, they are lower than values that have been reported during strenuous live fire training (Smith et al, 1995; 2001) and during actual firefighting activities (Barnard and Duncan, 1975).

THE IMPORTANT MESSAGE FROM THE STUDY

It is inherently physically demanding to be exposed to the heat of a fire while wearing protective gear, carrying an air pack, and using fire fighting tools. The public counts on firefighters to protect and rescue them. Don't make our firefighters victims themselves by deploying too few of them to do the job.