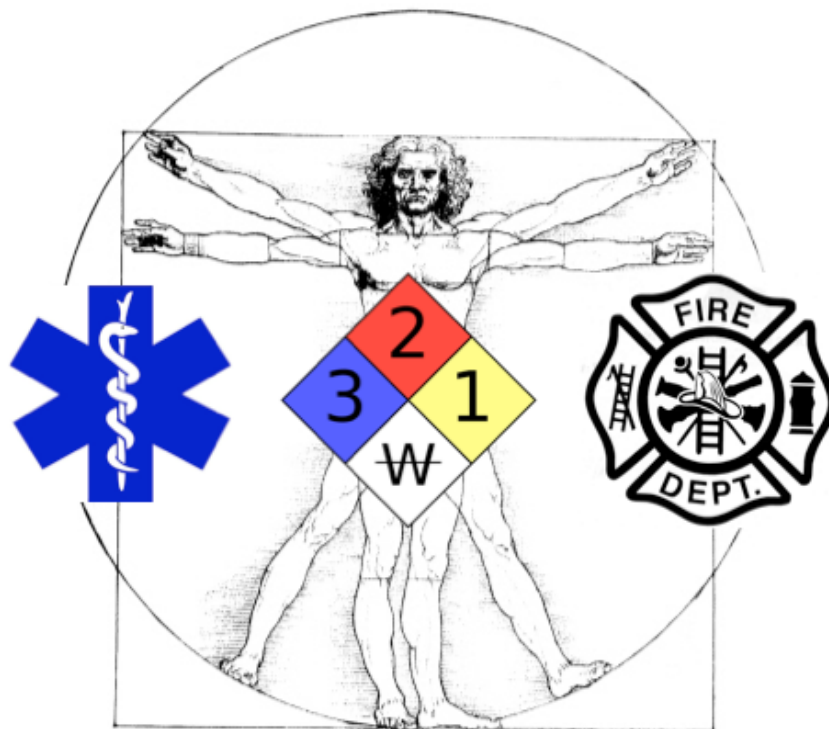

Size matters... The effect of SCBA cylinder size on balance

A review of Effects of air bottle design on postural control of firefighters. Original article written by: P Hur et al. Applied Ergonomics 2015 48:49-55.

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This summary was crafted by Conner Meyer, ERHPL intern and VMI undergrad.



www.firefighterresearch.org

Introduction

The added weight of thermal protective clothing and self-containing breathing apparatuses (SCBA) presents multiple challenges to the firefighter, in order to safely engage a fire. This equipment increases the risk of slips, falls, and many other forms of injuries. One cause of injuries among firefighters during an engagement with a fire is unexpected perturbations to balance. Additionally, poor vision through a mask and smoky conditions reduce stability. This study reported on the effect of various SCBA cylinder sizes on standing balance among a group of firefighters.

What the study did

Researchers from worked with 24 firefighters at the Illinois Fire Service Institute at the University of Illinois to study four different types of air bottles (SCBA). The cylinders varied in size and material; there was an aluminum cylinder, a carbon fiber bottle, a fiberglass cylinder, and a specially redesigned cylinder that was shorter / thicker and placed low on the back. The firefighters wore thermal protective clothing and one of the four different breathing apparatuses. They were then asked to stand comfortably on a force plate attached to a tether, which pulled the firefighter backwards without warning. During some of the trials, the firefighter was asked to keep his eyes closed. The postural sway in front / back and left / right direction was measured.

What the study reported

Heavier cylinder (aluminum and fiberglass) increased postural sway around the ankles in the left / right direction when compared to the lighter cylinders (carbon fiber and specially redesigned). Diminished vision was also found to affect postural sway in all directions. Interestingly, increasing the mass of the breathing apparatus bottles did not increase random movement in the front / back direction by itself but did increase postural sway when combined with reduced vision.

What it means for the fire service

This study showed that heavier cylinders challenged standing balance more than lighter cylinders. Combined with poor vision this greatly increases random movement and postural sway. In a fire, the firefighter will be exerting themselves and random perturbations may be much more powerful and could increase chance of a slip, fall, or other form of injury. This has important implications when purchasing new SCBA units. The trend towards buying larger cylinders to increase air supply may have a negative consequence by increasing the risk of fall injuries.

In order to decrease chances of slips and falls on the fireground, firefighters should increase the stance width when standing in one position. There may be additional advantages to wearing lighter breathing apparatus cylinder that are reduced in weight, smaller, and have a center of mass that is closer to the body's center of gravity. The firefighters in this study were not moving when tested so the effects seen here may not be relevant in situations where the firefighter is moving or navigating obstacles.

