Validation of the Firefighter WFI Treadmill Protocol
For Predicting VO2max in Healthy Male Volunteers

Nadarajah, R, 1Dolezal BA, 1Abrazado M, 1Storer TW, 1Batalin M, 1Smith, DL, 1Cooper CB.
1Exercise Physiology Research Laboratory, David Geffen School of Medicine, 2Institute of Technology Advancement, Henry Samuel School of Engineering, UCLA; 3Health and Exercise Sciences, Skidmore College

ABSTRACT

The WFI (USFA Wellness Fitness Initiative) treadmill protocol is recommended by the National Fire Protection Association (NFPA) to assess aerobic capacity. However, predictions of VO2max from submaximal tests can have errors that lead to erroneous conclusions about fitness. PURPOSE: To investigate the level of agreement between aerobic capacity (VO2max) predicted from a standardized treadmill protocol (USFA Wellness Fitness Initiative, WFI-T) and direct measurement of VO2max using indirect calorimetry.

METHODS: A physiological monitor affixed to a chest strap (BioHarness-3, Zephyr Technologies, Annoplis, MD) was used to monitor and transmit VO2max via wireless technology to a mobile application (PHASERNet) developed at UCLA specifically for firefighters.

RESULTS: Simultaneously, a mobile metabolic measurement system was used to measure oxygen uptake (VO2) breath-by-breath and FC via 12-lead electrocardiography. VO2max was identified using established criteria.

CONCLUSIONS: • This study shows that the WFI-TM generally predicts true VO2max within 11% error. As such it could play an important part in assessment of cardiovascular fitness in the fire fighters.
• Our findings differ from the recent study by Drew-Nord et al. (4) that found more favorable agreement between WFI-TM and indirect calorimetry.
• However, there is a tendency to overestimate aerobic capacity in those less fit to underestimate in those more fit leading to a clustering of values around 42 ml·kg-1·min-1. A criterion used in some fire departments to assess fitness for duty.

REFERENCES
1. The Joint Labor Wellness Initiative Third edition

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INTRODUCTION

Aerobic capacity (VO2max) is a measure that defines the limits of cardiovascular function. Previous studies on firefighters have shown that a mean of 41.5 ml/kg·min-1 is required to complete standard fire suppression tasks while wearing personal protective equipment (1). Thus if one is to determine that a firefighter’s cardiovascular system can withstand the demands of firefighting, it is paramount that the testing protocol used to measure VO2max is accurate. VO2max can be tested using indirect, maximal or submaximal protocols. Submaximal tests are less expensive and easier to administer, which makes them more suitable for departments to implement. However, previous submaximal tests endorsed by the WFI to predict VO2max have often shown substantial error that may lead to erroneous conclusions about the fitness of an individual as well as decisions regarding fitness enhancement. To improve the accuracy of the submaximal protocol to predict VO2max, a newly refined prediction equation for (for what is now known as the WFI treadmill test (WFI-TM)) have been developed (1).