Validation of the firefighter WFI treadmill protocol for predicting VO_2 max

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Background	The Wellness-Fitness Initiative submaximal treadmill exercise test (WFI-TM) is recommended by the US National Fire Protection Agency to assess aerobic capacity (VO_2 max) in firefighters. However, predicting VO_2 max from submaximal tests can result in errors leading to erroneous conclusions about fitness.
Aims	To investigate the level of agreement between VO_2 max predicted from the WFI-TM against its direct measurement using exhaled gas analysis.
Methods	The WFI-TM was performed to volitional fatigue. Differences between estimated VO_2 max (derived from the WFI-TM equation) and direct measurement (exhaled gas analysis) were compared by paired *t*-test and agreement was determined using Pearson Product-Moment correlation and Bland–Altman analysis. Statistical significance was set at $P < 0.05$.
Results	Fifty-nine men performed the WFI-TM. Mean (standard deviation) values for estimated and measured VO_2 max were 44.6 (3.4) and 43.6 (7.9) ml/kg/min, respectively ($P < 0.01$). The mean bias by which WFI-TM overestimated VO_2 max was 0.9 ml/kg/min with a 95% prediction interval of ±13.1. Prediction errors for 22% of subjects were within ±5%; 36% had errors greater than or equal to ±15% and 7% had greater than ±30% errors. The correlation between predicted and measured VO_2 max was $r = 0.55$ (standard error of the estimate = 2.8 ml/kg/min).
Conclusions	WFI-TM predicts VO_2 max with 11% error. There is a tendency to overestimate aerobic capacity in less fit individuals and to underestimate it in more fit individuals leading to a clustering of values around 42 ml/kg/min, a criterion used by some fire departments to assess fitness for duty.
Key words	Firefighters; fitness tests; physical fitness.