

Response to letter from RJ Shephard ‘Problems of medical supervision and physiological validity encountered with fixed-rate step tests’

Dominique Hansen · Paul Dendale ·
Neree Claes

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We would like to comment on the suggestions/questions raised by Shephard (2012) in his recent letter.

Firstly, in our publication, we did not mention whether medical supervision was present during the exercise testing (Hansen et al. 2011). However, prior to all step tests, a maximal cardiopulmonary exercise test (CPET) with ECG analysis was executed by two physicians in order to exclude any patients with cardiopulmonary abnormalities. In this way, the medical safety (risk for cardiovascular and/or pulmonary events) of the step-testing procedure was optimised. Moreover, all step tests were executed in the close proximity of a physician, and no adverse events were noted.

Shephard (2012) argues that the proportion of subjects with values above SD 0.83 should be 21% instead of 41%, based on the assumption that the data were normally distributed. However, the Kolmogorov–Smirnov test revealed that our data were not normally distributed ($p = 0.007$). As a result, we confirm that 41% of our subjects had an exercise intensity above 95% of the CPET peak oxygen uptake ($\dot{V}O_2$) during step testing.

In addition, Shephard (2012) proposes the Canadian Aerobic Fitness Test as a good alternative for fixed-rate

step tests, because in this test the relative exercise intensity is gradually increased. We agree with this proposal. We also feel that, after observing the outcome of our study, less-severe step tests (or step tests with gradually increasing stepping rate) are preferable in the evaluation of subjects unaccustomed to exercise. However, Shephard is surprised that we did not select this step-test type. Prior to our study, we observed that fixed-rate step tests are often promoted in physical fitness settings, and are often a component of physical education and/or physical therapy educational training, at least in Europe. However, data regarding the medical safety of this type of step test seemed lacking. As a result, this formed the impetus for our study. After completion of our study, we concluded that the medical safety of this fixed-rate step test might not be as high as previously assumed. Proposing to lower the step height, step frequency, and/or allowing the subjects to self-select their stepping frequency with the aim to improve medical safety each seems a logical adaptation for those who prefer fixed-rate step tests. Examples of such modifications in fixed-rate step tests can be found in literature (Petrella et al. 2001).

The fact that in the earlier literature, $\dot{V}O_2$ has been investigated during step testing and compared to $\dot{V}O_2$ during cardiopulmonary exercise testing, does not make our findings less clinically relevant. On the contrary, despite these previous publications, fixed-rate step tests remain in widespread use with the assumption that these tests elicit low-to-moderate exercise intensities. We felt that this widely held belief should be challenged, once again, to improve the medical safety of exercise testing in the clinical setting.

Finally, we acknowledge that Thomas et al. (1993) indeed examined the Canadian Aerobic Fitness Test.

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D. Hansen (✉) · P. Dendale · N. Claes
Faculty of Medicine, Hasselt University,
Diepenbeek, Belgium
e-mail: hansen_dominique@yahoo.com

D. Hansen · P. Dendale
Heart Centre Hasselt, Jessa Hospital,
Hasselt, Belgium

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