Author's response to reviews

Title: The Six Minute Walk Test Accurately Estimates Mean Peak Oxygen Uptake

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The Six Minute Walk Test (6MWT) has gained significant popularity among cardiologists, pulmonologists and the transplant community. In the past 3 years, according to a recent Pub Med search, there have been about 700 papers published in English regarding the Six (or 6) Minute Walk Test and the term has been in the title of 89 papers. This indicates its continued usage. However, exactly how well the 6MWT predicts directly measured peak oxygen uptake (peak VO2) has not been clearly defined.

Our study is based on 1,083 pairs of data from 11 studies of patients with various cardiopulmonary disorders studied at centers around the world including North America, Europe and Asia. We used linear mixed model analysis to determine if inter-site factors, such as test technique or patient selection, significantly affected the error of estimating peak VO2 from the 6MWT. In fact, somewhat surprisingly, it did not, and so we were able to create a generalized equation that could be used with little loss-of-accuracy regardless of patient selection or exercise protocol.

When predicting an individual’s peak VO2, we found a standard error of estimate (SEE) of 3.82 ml/kg/min for the pooled data. The error introduced by inter-site factors only reduced the SEE to about 3.66 ml/kg/min. This degree of error indicates that, although the 6MWT is correlated with peak VO2, it has limited accuracy for any given individual. This study confirms with finality, that 6MWT results cannot be used to estimate peak VO2 in an individual regardless of disease or how scrupulously the exercise protocols are performed. It shows that the large standard error is, in fact, unavoidable and due to the inherent measurement errors of the two tests.

On the other hand, our equation quite accurately predicted the mean peak VO2 of the various study groups where the standard error was only about 1 ml/kg/min or +/- 7% of mean peak VO2. This equation can be used to compare the mean peak VO2 of different study groups even if they have different diseases and have been exercised under different protocols. We believe that the mean peak VO2 of a study group is an important factor when monitoring the natural history of a disease or assessing the efficacy of various forms of treatment. For example, patients may respond better to a treatment earlier in their disease process when they have greater aerobic capacity. Conversely, a treatment may only show efficacy for the most severely incapacitated with a very low aerobic capacity. Our equation allows researchers to accurately estimate the mean peak VO2 of a group where the 6MWT has been used but CPET has not been performed, and so compare them in terms of aerobic capacity.

The study has been IRB approved. I, as the corresponding author, had full access to all the data and take responsibility for the integrity of the data and the accuracy of the data analysis. None of the authors have any conflict-of-interest or financial disclosures to report regarding this paper.