The 6-minute walk test in outpatient cardiac rehabilitation: validity, reliability and responsiveness: a systematic review

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CRD summary
The authors concluded that strong evidence suggested the 6-minute walk test was responsive to clinical change in patients following cardiac rehabilitation. This conclusion reflects the evidence presented, but possible error and bias in the review process, with questions about the validity of the quality assessment tool limits any conclusive judgement about the reliability of the review.

Authors' objectives
To examine the validity, reliability and responsiveness of the 6-minute walk test in patients undergoing outpatient cardiac rehabilitation.

Searching
MEDLINE, CINAHL, EMBASE, SPORTDiscus and The Cochrane Library were searched from 1948 to 2011 for articles published in English. The reference lists of included articles were scanned to identify further studies.

Study selection
Eligible for inclusion were full-text articles of trials and observational studies that compared the 6-minute walk test with an established reference test in people with coronary artery disease, before and after participating in outpatient cardiac rehabilitation.

The included studies varied in study design, and comprised men and women with a mean age between 52 and 76 years (where reported). Different protocols for the 6-minute walk test were reported. Many studies included the cycle exercise test as the gold standard reference test.

One reviewer selected the studies for inclusion in the review.

Assessment of study quality
Study quality was assessed using a tool developed from three established sets of criteria. Studies that scored over 60% positive responses were considered high quality; studies that scored less than 40% were low quality.

Two reviewers assessed study quality, and disagreements were resolved by consensus.

Data extraction
Data were extracted to enable conversion to mean differences and standard error. Correlations, percentage change and effect sizes were also presented.

Data were extracted by one reviewer, and checked by a second reviewer.

Methods of synthesis
Where possible, studies were combined in a random-effects meta-analysis. Statistical heterogeneity was quantified using $I^2$. Other synthesis was narrative.

Results of the review
Fifteen studies were included in the review. Of these, two studies assessed reliability (nine and 94 participants; one was high quality); eight assessed validity (sample size range 10 to 630; six were high quality); and 12 assessed responsiveness (sample size range 18 to 982; 11 were high quality).

Meta-analysis revealed strong evidence on responsiveness of the 6-minute walk test to changes in the clinical status of participants following cardiac rehabilitation. Results revealed an estimated mean difference in 6-minute walk distance of 60.43m (95% CI 54.57 to 66.30 metres; 14 studies; $I^2=60\%$) and this was statistically significant ($p<0.001$).
median effect size was 0.65.

There was moderate evidence to demonstrate the reliability of the 6-minute walk test, with an intra-class correlation coefficient of 0.97 and a 2% to 8% test-retest change (two studies). Moderate evidence was found for validity of the test, with correlations ranging from 0.56 to 0.93 in relation to maximum power, oxygen uptake and maximum metabolic equivalents during symptom-limited exercise tests. Two moderate/high quality studies found positive relationships between the test and peak heart rate at the ventilatory threshold during cycle exercise. Two of three moderate/high quality studies found moderate correlations (ranging from 0.54 to 0.62) between the 6-minute walking test and health and function outcomes, when quality-of-life questionnaires were used as reference tests. Other results for test validity were limited or inconclusive.

Further results on the discriminative ability of the test were reported in the paper.

**Authors’ conclusions**
Strong evidence suggests that the 6-minute walk test was responsive to clinical change following cardiac rehabilitation.

**CRD commentary**
The review question was clear. Inclusion criteria were adequately specified. Relevant data sources were accessed, but the restriction to articles published in English may have led to studies being overlooked, and the associated biases with these restrictions could not be ruled out. The review process did not appear to contain sufficient efforts to minimise error and bias for study selection.

The adapted quality assessment tool appeared to be appropriate, but justification for thresholds denoting high and low quality was not fully explained. The use of different methods of synthesis appeared appropriate, given the clinical heterogeneity presented in the study details. Statistical heterogeneity was quantified, where appropriate.

The authors’ conclusion reflects the evidence presented, but possible error and bias in the selection of studies and questions about the validity of the quality assessment tool (acknowledged by the authors) limits any conclusive judgement about the reliability of the review.

**Implications of the review for practice and research**
**Practice:** The authors stated that the 6-minute walk test was suitable for outcome assessment before and after cardiac rehabilitation.

**Research:** The authors stated that future research should focus on the intra- and inter-tester reliability of the 6-minute walk test, assess the validity of the test against treadmill exercise tests and explore the prognostic and predictive value of 6-minute walking distances in patients undergoing cardiac rehabilitation.

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