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**Six Minute Walk Test (6MWT)**

**General Description**

**Purpose**
The original purpose of the six minute walk was to test exercise tolerance in chronic respiratory disease and heart failure. The test has since been used as a performance-based measure of functional exercise capacity in other populations including healthy older adults, people undergoing knee or hip arthroplasty, fibromyalgia, and scleroderma. It has also been used with children.

**Content**
The six-minute walk test (6MWT) measures the distance an individual is able to walk over a total of six minutes on a hard, flat surface. The goal is for the individual to walk as far as possible in six minutes. The individual is allowed to self-pace and rest as needed as they traverse back and forth along a marked walkway.

**Developer/contact information**
The 6MWT was developed in 1963 by Balke to evaluate functional capacity[**1**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt01). Different variations of the timed walk have been tested, and the six minute timed walk was recommended given its reproducibility and ease of administration compared to longer timed tests[**2**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt02). Later studies showed that timed walks under 4 minutes were found to be not as sensitive to evaluate the differences in walked distances[**3, 4**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt03).

**Number of items in scale**
Not applicable.
**Subscales**
Not applicable.

**Populations**
The 6MWT was developed in frail elderly patients 60-90 years of age referred to a geriatric hospital, and it targets community dwelling frail elders[**1**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt01).  However, the test has been used in a variety of chronic disease adult and pediatric populations as well as in healthy adults.

**Other uses**
The 6MWT has also been used to detect changes following interventions to improve exercise tolerance for healthy older adults[**5, 6**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt05) as well as people with rheumatologic conditions such as knee or hip osteoarthritis[**7**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt07) and fibromyalgia[**8**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt08). The 6MWT has been used with a variety of other conditions such as heart failure[**9, 10**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt09), chronic obstructive pulmonary disease (COPD)[**11**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt11) and stroke[**12, 13**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt12) It has also been used to predict hospitalization and mortality[**6,14**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt06).

**WHO ICF Components**

Changing and maintaining body position (d410-d429) and walking (d450).

**Administration**

**Method** This is ideally conducted in an enclosed, quiet hallway by a single administrator. However, it is important to note that there are variations among studies in how the test is conducted which affects performance. These variations include the instructions provided to the participant, the number of turns in the course, the frequency and type of encouragement given, and the number of trials performed. Each of these variations will be outlined briefly.

* **Test instructions:** Due to the differing functional statuses of participants, the 6 minute walk test may cause some people to perform at higher exertion levels than others. For patients with moderate to severe heart or lung disease, there are detailed instructions provided by the American Thoracic Society (ATS)[**15**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt15) which highlight how patients may become out of breath or exhausted and instruct them on taking rest breaks. In contrast, some articles instruct people to walk as quickly as possible[**14**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt14). While many studies do not report the exact instructions, most describe the instruction as having participants walk at their usual pace or a comfortable pace and to walk as far as possible. Participants are instructed prior to the test to wear comfortable clothing and shoes and to use their typical walking aid during the test.
* **Walkway length and number of turns in the course:** The ATS recommends an indoor, 30 meter corridor or walkway with cones placed at the beginning and end of the 30 meter boundary to indicate turns. In the literature, the corridor distance across studies varies which is likely due to the need to use what is readily available.  A recent study44 in stroke patients suggest the 30 meter length (versus 10 or 20 meter) resulted in the longest distance covered. Although treadmills have been used to conduct the 6MWT, treadmills may underestimated total distance compared to the standard method done in a hallway or exercise room.45-46
* **Use of Encouragement:** Encouragement is often given and is typically standardized, although it varies in frequency across studies from providing encouragement every 30 seconds to every 2 minutes. Encouragement increases the distance walked[**6**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt06) and if used, the exact protocol should be reported.
* **Number of Trials Performed:** Number of trials has been known to increase 6 minute walk distance[**17-19**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt17), with largest improvements seen over the first 3 trials[**4, 20**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt04). Variation on the tests performed is less than 10% between the first two trials and may reflect true variation in functional capacity[**17, 21**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt17). Therefore, one to two practice trials may be useful[**4**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt04). In most populations, at least two practice walks should be administered (with adequate time for rest and recovery) prior to recording measurements[**22**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt22).
* **Safety Issues and Contraindications:** As with any physical performance test, technicians should have certification in Basic Life Support. For people with moderate to severe heart disease, additional safety precautions are recommended by the ATS[**15**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt15) including certification in advanced cardiac life support and access to supplies and equipment (such as a crash cart) that would allow for a rapid response to an adverse event. Contraindications for this test as recommended by the ATS include unstable angina in the previous month, myocardial infarction in the previous month, and high blood pressure (resting heart rate of > 120, systolic blood pressure of 180 mm Hg, or diastolic blood pressure > 100 mm Hg). The test should be stopped if a person reports chest pain, intolerable shortness of breath, leg cramps, staggering, diaphoresis, or pale/ashen appearance[**15**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt15).
* **Training:** A standard protocol should be followed and each new technician should be trained in test administration and observed several times.

**Time to administer/complete**
15 minutes or less.

**Equipment needed**

* A 30 meter, pre-measured flat walking area with interval markings every three meters.
* Cones or brightly colored tape to mark boundaries of the course
* Watch or timer to time 6 minutes
* Chair available if patients need to rest during testing

**Availability/cost**

Readily available

**Scoring**

**Outcomes measured**
The primary outcome is the distance covered in meters or converted measure (such as feet) over 6 minutes. To measure functional aerobic capacity or general fitness, this test may be used in conjunction with VO2 testing (often using a portable metabolic system which measures oxygen uptake during exercise).

**Interpretation of scores**

A lower score (reflecting less distance covered in 6 minutes) indicates worse function.  **Method of scoring**
Administrator tallies the total distance walked using the pre-marked intervals as a guide.

**Time to score**
Minimal

**Training to score**
Minimal

**Training to interpret**
None required.

**Norms available**
The six minute walk distance in healthy adults has been reported to range from 400m to 700m[**23**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt23). Age and sex-specific reference standards are available and may be helpful for interpreting 6MWT scores for both healthy adults and those with chronic diseases.47 However, it is difficult to use normative values because of the differing methods used in studies. An improvement of 54m has been shown to be a clinically important difference[**24**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt24) in a study of people with chronic lung disease which is similar to the recommended criteria of meaningful clinical change of 50m based on analyses from a sample of 692 community living older adults and individuals who have survived a stroke[**25**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt25).

**Psychometric Information**

**Reliability**

*Test/retest.* Test-retest reliability has been reported as high, with an ICC of 0.90 at baseline, 0.88 at 18 weeks, and 0.91 at 43 weeks in a cohort of patients with heart failure (HF)[**26**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt26). An ICC of 0.80 (95% CI=0.69-0.87) was reported after one year in a group of patients with CHF and associated comorbidities including diabetes and hypertension[**27**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt27). An ICC of 0.73 to 0.98 has been reported in individuals with fibromyalgia following a timeframe of 10 days or four weeks in two independent studies[**28, 29**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt28).

**Validity**

*Content.* The 6MWT has been found to have content validity for patients with severe heart failure and pacemakers[**30, 31**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt30). Doubts have been raised about the validity of using the six-minute walk test with individuals with systemic sclerosis in particular with using the test as a measure of change in intervention studies.[**32**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt32).

*Criterion.* Moderate to high relationships have been reported (r=0.56 to r=0.88) between the 6MWT distance and peak VO2 obtained by maximal exercise testing in persons with heart failure[**33, 34**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt33). Accuracy was 80% and sensitivity and specificity >90% compared to maximal oxygen uptake in 51 heart disease patients.48  In clients with chronic heart failure, Riley et al.[**35**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt35) found that the peak VO2 in the 6MWT was similar to or higher than peak VO2. In certain subpopulations, the 6MWT sub-maximal test demonstrates moderately high associations with those of maximal exercise tests.

*Concurrent validity.* A negative correlation was found between the 6MWT distance and the New York Heart Association (NYHA) functional class classification (r=-0.60, n=94) indicating as the distance walked decreased, the NYHA classification increased (i.e., a reduced ability to perform physical activity)[**36**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt36). A positive correlation existed (r=0.624, n=94) between the 6MWT distance and the SF-36 physical function scale indicating as walk distance increased, physical function increased[**36**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt36). There was a weak negative correlation (r=-0.26, n=768) between the baseline 6MWT distance and the Minnesota Living with Heart Failure Questionnaire that looks at health-related quality of life[**26**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt26).

**Minimally clinical important difference**
Redelmeier et al.[**24**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt24) reported a clinically significant mean change of 54 meters (95% CI, 37-71 m) in patients' perception of exercise tolerance in 112 patients with stable, severe COPD. O'Keeffe et al.[**10**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt10) reported a clinically significant mean change of 43 m in 45 elderly patients with heart failure. They noted more responsiveness to change in deterioration than improvement in people with heart failure. Perera et al.[**25**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt25) described a meaningful clinical change of 50m based on analyses from a sample of 692 community living older adults and individuals who have survived a stroke. However, the minimal clinically important difference is slower, 25 meters, for coronary disease patients after acute coronary syndrome.49

**Responsiveness/sensitivity to change.**
Olsson et al.[**37**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt37) performed a systematic review to assess the 6MWT's ability to measure change over time following the use of pharmacological and non-pharmacological interventions. A total of 46 placebo-controlled trials were reviewed. Thirty-nine of the trials involved pharmacological interventions and seven trials included non-pharmacological treatments. Results indicate significant changes in 6MWT distance in four out of seven of the non-pharmacological trials and only nine out of 39 pharmacological trials. O'Keeffe et al.[**10**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt10) assessed the reproducibility and responsiveness in patients with heart failure between a quality of life assessment and the six-minute walk test. In this case, the degree of correlation between the 6MWT distance and the global rating of change in cardiac status was good (r=0.78).  Olper et al46, reports the standard hallway method has slightly better responsiveness to change (effect size 0.9) than the treadmill 6MWT (effect size 0.6).

**Comments and Critique**

The six-minute walk test (6MWT) was first used in the clinical setting to test exercise tolerance in individuals with chronic respiratory disease and respiratory failure. Current literature reports its use as a submaximal exercise test to measure functional exercise capacity (i.e., the ability to engage in physically demanding activities of daily living)[**22**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt22) in individuals with a wide variety of characteristics including healthy older adults and those with chronic heart and lung disease, heart failure, fibromyalgia, peripheral arterial disease and neurological conditions[**38**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt38) as well as with older adults. With respect to the potential limitations in scleroderma, the pervading theme is that the 6MWT's lack of discriminative ability and association with clinical worsening, limit its use as an outcome measure for clinical trials[**32, 39**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt32). While it is a practical and simple test that can be repeated to determine changes associated with the implementation of an intervention designed to improve functional capacity, the multi-system nature of scleroderma and other rheumatological conditions, as well as the common co-morbidities present in an aging population, hinders the ability to 6MWT to document organ or system-specific changes[**32**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt32) associated with interventions. Moderate to strong correlations exist (r=0.56 to r=0.88) between the 6MWT distance and peak VO2 obtained by maximal exercise testing[**33, 34**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt33). Variations in testing methods that allow for a learning effect or motivation through verbal cuing may lead to disparate results. The American Thoracic Society released guidelines for the 6MWT and suggests adherence to standardized methods to minimize variances.

Evidence suggests that variations in psychometric properties exist based on type of diagnosis. The minimally clinical important difference reportedly varies based on diagnosis.

It is suggested that the 6MWT may be useful as a self-administered outcome tool[**4**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt04). Although not thoroughly investigated, the authors indicate that promoting self-awareness and management of physical activity, such as walking, can inform the individual of changes in their health status, which may prompt a change in interventions. Further research is needed in this area.

**6MWT FOR CHILDREN**

This review has primarily focused on the use of the 6 minute walk test in adults. There have been some studies of the 6 minute walk as a test of exercise or aerobic capacity in children (either who were considered healthy or those with varying chronic conditions)[**40-43**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt40). Similar to the studies in adults, differences in administration of the 6 minute walk makes results of these studies difficult to synthesize. Age, height, and weight are often factors that affect 6 minute walk times[**40-43**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt40). Reliability estimates (ICC) in children range from  0.96 – 0.98 and minimal clinically important differences are highly variable and likely depend heavily on the type of chronic condition[**50**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt50).  Pearson correlations between 6MWT and VO2max are also highly variable ranging from -0.25 to 0.46[**50**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt50). Among children with juvenile idiopathic arthritis (JIA), the 6 minute walk was associated with submaximal levels of exercise intensity suggesting it is a good measure of functional capacity[**43**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt43). In another study in which children with JIA were a subgroup, 6 minute walk distance multiplied by body weight was a stronger measure than 6 minute walk distance alone. Recently the 6MWT has been used as an outcome measure in weight loss studies and may be a practical and promising assessment tool for exercise performance in the obese pediatric population [**51, 52**](http://www.rheumatology.org/practice/clinical/clinicianresearchers/outcomes-instrumentation/6MWT.asp#mwt51). Further work is needed to test the 6 minute walk in children with rheumatological conditions using standardized protocols.

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Revised October 2011 by ARHP Research Committee

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